NUCLEAR SCIENCE ABSTRACTS

Volume 32 Number 3

Abstracts 5841-8434

August 15, 1975

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ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION

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Volume 32, Number 3, August 15, 1975

NUCLEAR SCIENCE ABSTRACTS

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Published by the ERDA Technical Information Center

Nuclear Science Abstracts provides the only comprehensive abstracting and indexing coverage of the international nuclear science literature. It covers scientific and technical reports of the U. S. Energy Research and Development Administration and its contractors, other U. S. Government agencies, other governments, universities, and industrial and research organizations. In addition, books, conference proceedings, individual conference papers, patents, and journal literature on a worldwide basis are abstracted and indexed. Each issue of *Nuclear Science Abstracts* includes four indexes: subject, personal author, corporate author, and report number.

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Numerous organizations, societies, and publishers throughout the world provide *Nuclear Science Abstracts* with advance page-proof copy of their publications.

A list of the journals scanned regularly and the abbreviations used appears in the January 15 issue of *Nuclear Science Abstracts* and is supplemented in the July 15 issue. The January 15 issue also describes the scope and arrangement of the subject matter covered in *Nuclear Science Abstracts*. The subject matter covered is also described in TID-4552, *Subject Scope of Nuclear Science Abstracts*, available free from the USERDA Technical Information Center, P. O. Box 62, Oak Ridge, Tennessee 37830. An outline of the subject categories appears in the Contents of each issue.

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Personal Authors

Each author's name is indexed in the form appearing on the document abstracted, with the exception that given names are reduced to initials:

HOLLOWAY, J.A., Survey of image processing methods for radiography, 31:16451
HOLLWEG, J.V., Hydromagnetic waves in interplanetary space, 31:17953
HOLMBERG, E.B., Distribution of clusters of galaxies as related to galactic absorption, 31:16040
HOLMES, J.J., See BATES, J.F., 31:17444

Subjects

The subject index consisting of entries naming specific materials, objects, and processes is arranged alphabetically. Document titles, informative phrases, or both specific to these entries are arranged alphabetically under the entries.

Examples:

NUCLEAR POWER PLANTS/REACTOR LICENSING
Experience acquired in the design and construction of operating plants (German Federal Republic), 31:19104
NUCLEAR POWER PLANTS/REACTOR SAFETY
Conception of radiation safety in atomic electric power plants, 31:15032 (CONF-701074-P1)
NUCLEAR POWER PLANTS/SITE SELECTION
Safety-related site parameters for nuclear power plants, 31:19052 (WASH-1361)
Status and development of nuclear power in the Federal Republic of Germany, 31:19105
NUCLEAR PROPERTIES/RESEARCH PROGRAMS
Accelerator physics group progress report, July--December 1973 (Research summaries), 31:16544 (INS-R-139)

Corporates

Technical report literature is indexed using the name of the organization or institution responsible for the issuance of the report.

17606 (ANL/HEP-7440, pp I.1-I.12) ACCELERATED POLARIZED PROTONS AT THE ZGS. Ratner, L. G. **(Argonne National Lab., IL).** Feb 1974.
From symposium on high energy physics with polarized beams; Argonne, Illinois, USA (8 Feb 1974).
In symposium on high-energy physics with polarized beams.

is indexed as:

ARGONNE NATIONAL LAB., ILL. (USA)
Accelerated polarized protons at the ZGS, 31:17606 (ANL/HEP-7440)
Acceleration of polarized protons in synchrotrons, 31:17692 (ANL/HEP-7440)
Analysis of population, birth, and death statistics in the counties surrounding the Big Rock Point Nuclear Power Station, Charlevoix County, Michigan, 31:16552 (ANL-8149)
Argonne polarized target facilities, 31:17762 (ANL/HEP-7440)
Calculation of transient fission-gas release from oxide fuels, 31:19031 (ANL-8143)

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Technical report literature is also indexed using report numbers. This index includes information on where individual reports may be obtained. While not reports, patents and conference papers are indexed here as a matter of convenience.

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1359	31:16524	Dep. NTIS, $10.00
1361	31:19052	Dep. NTIS, $3.75
WCAP-	**(Misc.)**	
7966	31:19053	Dep. NTIS, $5.50
XDC-		
60-3-68	31:18403	Dep. NTIS, $7.25
XN-	**(Non-ERDA)**	
74-21(Rev.1)	31:19054	
409(Suppl.4) (Rev.1)	31:18750	Exxon, Richland, WA
Y-		
1966	31:19188	Dep. NTIS, $4.00

AVAILABILITY OF PUBLICATIONS ABSTRACTED

Public availability of all U. S. Energy Research and Development Administration reports is indicated in the report number indexes. The availability of other reports, when known, is also indicated. The availability of some unnumbered reports is given in the abstract.

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Information on the availability of the published literature and unpublished conference papers abstracted in *Nuclear Science Abstracts* can be obtained from the USERDA Technical Information Center, P. O. Box 62, Oak Ridge, Tennessee 37830.

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Volume 32, Number 3 August 15, 1975

NUCLEAR SCIENCE ABSTRACTS

CHEMISTRY

Analytical and Separations Chemistry

5841 (CEA-CONF-2737) THE AUTOMATION OF THE CONTROL AND CHEMICAL ANALYSES IN FUEL REPROCESSING. Perez, J. J. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Foses, 92 (France). Dept. de Genie Radioactif). 1974. 10p. (In French). INIS.

From French-Spanish colloquium; Marcoule; Fontenay-aux-Roses, France (25 Apr 1974).

Automation studies have been carried out in two directions. The first concerns physical nondestructive tests for on-line measurements. The most frequently used techniques are gamma absorption measurement, conductivity measurement without electrodes, α and γ radiometry and absorption spectrophotometry. The second direction is that of chemical analysis with reagents which are used by means of modular and sequential robots which prepare samples either on-line or from receptacles brought to the laboratory. This led to working out an original system that is modular and pneumatic in design and called DIMA or Dispositif de Multi-Analyse. (FR)

5842 DETERMINATION OF GASEOUS ELEMENTS IN METALS. Melnick, L. M.; Lewis, L. L.; Holt, B. D. (eds.). Chemical Analysis, Volume 40. New York; John Wiley and Sons, Inc. (1974). 752p.

Seven chapters were abstracted and indexed separately for NSA. The remaining chapter titles are: behavior of gaseous elements in metals; vacuum fusion furnace reactions; vacuum and inert-gas fusion; electrical discharge extraction methods; optical and mass-spectroscopic methods; hydrogen; nitrogen; oxygen; Al, Zn, Cd, Sn, Pb, Sb, and Bi; Cr, Mn, and V; ferroalloys; iron and steel; Co, Ni, and Cu. (JGB)

For abstracts of individual chapters see: 5843–5847, 5872, and 5873.

5843 ALKALI METALS. Kallmann, S. (Ledoux and Co., Teaneck, NJ). pp 361-397 of Determination of Gaseous Elements in Metals. Melnick, L. M. (Ed.). New York; John Wiley and Sons, Inc. (1974).

The discussion is presented under the following section headings: introduction; effect of contaminants; reactions of alkali metals with oxygen and nitrogen (sections on Li, Na, K, Rb, Cs); reactions of alkali metals with hydrogen; sample storage; sampling (sections on liquid metals in dynamic and static systems and solid metals; methods for determination of oxygen (amalgamation, alkyl halide, fluorination, methanol solution and Karl Fischer titration, liquid ammonia for oxygen in lithium, distillation, plugging meter, electrochemical oxygen meter, freezing-point depression, resistivity, activation analysis); methods for determination of hydrogen (diffusion gasometric procedure, vacuum fusion and similar methods, amalgamation, isotope dilution, and miscellaneous); and, determination of nitrogen. (105 references.) (JGB)

5844 ALKALINE EARTH METALS. Holt, B. D. (Argonne National Lab., IL). pp 399-499 of Determination of Gaseous Elements in Metals. Melnick, L. M. (ed.). New York; John Wiley and Sons, Inc. (1974).

Section titles include: metallurgical aspects; standard samples (Be, Mg, Ca, Sr, and Ba); sampling and sample preparation; and analysis (determination of hydrogen, nitrogen, and oxygen in Be, Mg, Ca, Sr, and Ba by various methods including isotope dilution and activation analysis). (98 references.) (JGB)

5845 TITANIUM, ZIRCONIUM, AND HAFNIUM. Covington, L. C.; Miles, M. J. (Titanium Metals Corp. of America, Henderson, NV). pp 585-604 of Determination of Gaseous Elements in Metals. Melnick, L. M. (Ed.). New York; John Wiley and Sons, Inc. (1974).

The discussion is presented under the following section headings: metallurgical aspects; historical development (of methods of determination of H, N, and O, including isotope dilution and activation analysis); standard samples; sampling and sample preparation; analysis; and recommended methods. (53 references.) (JGB)

5846 NIOBIUM, TANTALUM, MOLYBDENUM, AND TUNGSTEN. Mallett, M. W. (Battelle Memorial Inst., Columbus, OH). pp 605-629 of Determination of Gaseous Elements in Metals. Melnick, L. M. (Ed.). New York; John Wiley and Sons, Inc. (1974).

Section titles include: metallurgical aspects; historical development (of methods for analysis for H, O, and N); standard samples; sampling and sample preparation; analysis; and recommended methods. (91 references.) (JGB)

5847 SCANDIUM, YTTRIUM, LANTHANIDE, AND ACTINIDE ELEMENTS. Dallmann, W. E.; Fassel, V. A. (Ames Lab., IA). pp 631-672 of Determination of Gaseous Elements in Metals. Melnick, L. M. (Ed.). New York; John Wiley and Sons, Inc. (1974).

Section titles include: introduction; metallurgical aspects; historical development (of methods for determination of H, O, and N, including activation analysis); standard samples; sampling and sample preparation; analysis (various methods for determination of H, O, and N, including activation analysis for O); and recommended procedures. (88 references.) (JGB)

Activation and Nuclear Reaction Procedures

Refer also to abstracts 6791, 6792, and 6890.

5848 (AE-502) DEPTH DISTRIBUTION STUDIES OF CARBON, OXYGEN, AND NITROGEN IN METAL SURFACES BY MEANS OF NEUTRON SPECTROMETRY. Lorenzen, J. (Aktiebolaget Atomenergi, Studsvik (Sweden)). Mar 1975. 54p. Dep. NTIS (US Sales Only) $5.75.

A method was developed to reveal the depth distributions of the light elements carbon, nitrogen, and oxygen in heavy matrices. For this purpose steel and zircaloy samples were irradiated with deuterons and the neutron groups emitted in (d,n) reactions with the different light nuclei were measured using a time-of-flight technique. The method was applied to the study of steel samples that feature inhomogeneous carbon and nitrogen distributions and also to the measurement of diffusion profiles of oxygen in zirconium. With the present technique depth ranges of 10 to 15 μm can be analysed if the deuteron energy is chosen between 2.5 and 3.5 MeV. The depth resolution improves with penetration from being of the order of 1 to 2 μm at the surface to 0.5 μm at greater depths under optimum conditions. The detection limit of the light element increases with the atomic number of the matrix and the analysed depth. For oxygen in zirconium and carbon in steel the limit of detection is of the order of 100 ppm at depth of 10 μm. Limitations in the analysable range of the different profiles due to interfering neutron groups are discussed. The method is particularly useful for the study of oxygen profiles. It is less adequate for reactions with positive Q-values above 5 MeV. (auth)

5849 (A.R.E.A.E.E.-195) NEUTRON ACTIVATION ANALYSIS OF URINARY CALCULI. Souka, N.; Souka, S.; Sanad, W.;

Abdel-Rasoul, A. A. (Atomic Energy Establishment, Cairo (Egypt)). 1974. 17p. Dep. NTIS (US Sales Only) $4.00.

Neutron activation analysis of a collection of urinary calculi was undertaken. Search for silver, selenium, zinc, and cobalt was carried out. Cobalt presented a measurable concentration in all the investigated calculi. The cobalt content in oxalate stones (around 1200 ± 93 ppM), was found to be approximately five times its value in phosphate stones (around 200 ± 21 ppM). The cobalt content in the examined calcium oxalate-triple phosphate mixed calculi lies between both concentration levels. (auth)

5850 (CEA-CONF-2793) TRACE ANALYSIS BY ATOMIC EXCITATION AND NUCLEAR REACTIONS. Application to Ca, K, and F Distribution in Plants. Oberlin, J. C.; Fontenille, J. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Dept. de Recherche Fondamentale). 1973. 14p. (In French). INIS.

From colloquium on Si(Li) semiconductors; Grenoble, France (28 May 1973).

Micro-analyses by nuclear reactions and atomic excitation are used to determine the spatial distribution of fluorine, calcium, and potassium in the needles of Abies Alba. Fluorine, a pollutant, is detected by the nuclear reaction $^{19}F(p,\alpha_0)^{16}O$ at the 1350 keV resonance. Calcium and potassium are measured by their characteristic x-rays due to proton excitation. The efficiency and resolution of the detection system used for x-ray spectrometry was studied, after which a very simple program was developed to calculate the areas of the Kα and Kβ peaks of potassium and calcium and determine the respective concentrations of these two elements. (FR)

5851 (CRN-PN-74-31) ELEMENTARY ANALYSIS AND CONCENTRATION PROFILES BY NUCLEAR METHODS. Application to the Study of Ti and TiO_2 Thin Films Condensation. Bruhl, G. (Centre National de la Recherche Scientifique, 67 - Strasbourg (France). Centre de Recherches Nucleaires; Strasbourg-1 Univ., 67 (France)). 1974. 70p. (In French). INIS.

To study condensation processes in Ti and TiO_2 thin films prepared by sputtering, various nuclear methods used to analyze carbon and oxygen and to determine their concentration profiles in the samples. Usual methods for determining light elements in a matrix, including activation analysis by ^3He, are reviewed. An automatic counting system made possible the analysis of a large number of samples. Thus a systematic study of the operating conditions on thin film fabrication was made. Concentration profiles for ^{16}O and ^{18}O (enriched) were obtained from the form of the yield function of a $^{18}O(p,\alpha)^{15}N$ resonance and by the form of the direct capture γ ray from the $^{16}O(p,\gamma)^{17}F$ reaction. From the experimental results it was possible to define the best operating conditions for fabricating the thin films, as well as to propose some hypotheses on the build-up mechanism of ^{16}O and ^{18}O in thin films, made in an ^{18}O plasma. (FR)

5852 (DEMO-74/15) ACTANAL: A COMPREHENSIVE COMPUTER PROGRAM FOR ROUTINE ACTIVATION ANALYSIS USING Ge(Li) DETECTORS. Bock-Werthmann, W.; Papakostidis, G.; Grimanis, A. P.; Petrou, J.; Georghiou, D.; Vassilaki-Grimani, M. (Democritus Nuclear Research Center, Athens (Greece)). Dec 1974. 33p. Dep. NTIS (US Sales Only) $4.75.

An efficient, flexible, and economical computer program for neutron activation analysis using Ge(Li) detectors was developed and tested with a C.D.C. 3300 computer. It is written in FORTRAN language and based on computation of the net peak areas. The program corrects spectra for counting time and background and smooths them after the correction. It searches for the peak in a range of some channels on both sides of the expected peak maximum in order to check for zero or gain shift. It finds the peak boundary channels for integration and computes peak areas. It calculates the Compton contribution after skipping a number of channels beyond the peak boundaries and then computes the net peak areas. It corrects for cooling time and gives the results in parts per million including the standard deviation. In order to make it possible to analyze a great number of samples in a short time, special effort was taken to minimize the number of additional data which have to accompany the gamma spectra and still retain great flexibility for special conditions. This could be achieved for example by fully automatic correction for dead time and decay. Subroutines are included in the program for optional operations such as the measurement of photopeak areas according to the WASSON method or the total peak area method (TPA). The program also allows the possibility of measuring the left or right flank of a peak instead of taking the whole peak to avoid interference from other peaks of energy difference less than the resolution of the Ge(Li) detector. Corrections for nonlinearity between channel number and photopeak energy and a number of control steps to monitor statistical fluctuations are included to avoid doubtful results. (auth)

5853 (EUR-5282e) DETERMINATION OF 25 ELEMENTS IN BIOLOGICAL STANDARD REFERENCE MATERIALS BY NEUTRON ACTIVATION ANALYSIS. Guzzi, G.; Pietra, R.; Sabbioni, E. (Commission of the European Communities, Ispar (Italy). Joint Research Centre). 1974. 38p. Dep. NTIS (US Sales Only). $5.00. EUR B.Fr. 120.-.

"Standard and Certified Reference Materials" programme of the JRC includes the determination of trace elements in complex biological samples delivered by the U. S. National Bureau of Standards: Bovine Liver (NBS SRM 1577), Orchard Leaves (NBS SRM 1571) and Tomato Leaves. The study has been performed by the use of neutron activation analysis. Due to the very low concentration of some elements, radiochemical group or elemental separation procedures were necessary. (auth)

5854 RADIOACTIVATION DETERMINATION OF SMALL AMOUNTS OF IRIDIUM BY USING SOLVENT EXTRACTION OF ITS MERCAPTOENZOTHIAZOLATE. Rakovskii, E. E.; Yampol'skii, P. Ya.; Berliner, L. D. (Central Scientific-Research Geological Prospecting Inst. of Non-Ferrous and Noble Metals, Moscow). Zh. Anal. Khim.; 30: No. 3, 545-548(Mar 1975). (In Russian).

Solvent extraction of iridium with 2-mercaptobenzothiazole from HCl solutions was studied. A procedure has been worked out for radioactivation determination of small amounts of iridium with extraction-photometric determination of the carrier yield. (auth)

5855 USE OF STANDARD REFERENCE MATERIALS IN ACTIVATION ANALYSIS. Obrusnik, I. (Inst. of Nuclear Research, Rez); Kotas, P. Radioisotopy.; 16: No. 2, 159-173 (Apr 1975). (In Czech).

The existing demands on precision and namely accuracy of analytical procedures require the use of standard reference materials. These materials are prepared by standard procedures and their composition is certified even for trace elements. The reliability of an analytical method can be tested by comparative analysis of such materials. After many years of preparation of geological and biological standards, today standard reference materials produced by the National Bureau of Standards (USA) are commercially available. Their production and certification are described in detail in this article. The need for similar standard reference materials for the purposes of activation and trace analysis in our conditions is discussed. (auth)

5856 NON-DESTRUCTIVE NEUTRON ACTIVATION METHOD FOR SIMULTANEOUS DETERMINATION OF Fe, Zn, Ni, AND Co COMPONENTS IN SPINEL FERRITES AND SOLIDS. Riekstinya, D. V.; Tsirkunova, I. E.; Eglite, G. Ya. (Inst. of Physics, Riga). Latv. PSR Zinat. Akad. Vestis, Fiz. Teh. Zinat. Ser.; No. 1, 3-7 (1975). (In Russian).

A nondestructive method is developed for neutron activation determination of Fe, Zn, Ni and Co macrocomponents in spinel ferrites and solid solutions of $Co_xMg_{1-x}O$ and $Ni_xMg_{1-x}O$. The method is applicable at concentration contents of iron 40-50%, zinc 1-15%, nickel 1.5-40% and cobalt 0.05-0.5%. The effect of separate components on the obtained results is studied. (auth)

5857 APPLICATION OF HIGH VOLTAGE ELECTROPHORESIS FOR THE SEPARATION OF RADIONUCLIDES. VIII. Activation Analysis Determination of Rare Earths. Buchtela, K. (Oesterreichische Hochschule, Vienna). Mikrochim. Acta.; 1: No. 4, 413-424(Apr 1975). (In German).

Rapid separation by high voltage electrophoresis is used in activation analysis of the rare earth elements. Impurities in a commercially available rare earth sample are analyzed. A method is described to analyze the rare earth elements in mineral samples and exterrestrial material, by activation analysis using high voltage electrophoretic separation. The whole procedure takes approximately 2 hours. (auth)

5858 DETERMINATION OF MERCURY IN BISMUTH BY NEUTRON ACTIVATION ANALYSIS. Hirose, A.; Moriuchi, I.; Ishii, D. (Nagoya Univ., Japan). Anal. Chim. Acta; 75: No. 1, 41-46(Mar 1975).

A method has been developed for the determination of traces of mercury in bismuth by neutron activation analysis. After sample irradiation at a flux of $7 \cdot 10^{13}$ n cm^{-2} s^{-1} for 20 min, mercury was separated from bismuth by addition of ammonium sulfide and redissolution of bismuth (matrix) sulfide with nitric acid, and filtration of sulfur containing mercury on a membrane filter. The activity of 68- or 68-77-keV region, counted with a Ge(Li) or NaI (Tl) detector, was used for quantitative measurements. The method was applied to bismuth samples containing 0.1-100 ppM of mercury. (NL)

5859 DETERMINATION OF 17 TRACE ELEMENTS IN GALLIUM ARSENIDE BY REACTOR NEUTRON ACTIVATION ANALY-

SIS. Maenhout, W. (Ghent Rijkuniversiteit). Anal. Chim. Acta; 75: No. 1, 31-39(Mar 1975).

A method was developed for the simultaneous determination of 17 trace elements in gallium arsenide. The method involves reactor neutron irradiation of the samples, distillation of the arsenic matrix activity and Ge(Li) γ-ray spectrometry. For a sample size of 0.1 g and a 10-day irradiation at $2 \cdot 10^{13}$ n cm^{-2} s^{-1}, the detection limits vary from 70 ppB (tin) down to $5 \cdot 10^{-3}$ ppB (scandium). (NL)

5860 MULTIELEMENT NEUTRON ACTIVATION ANALYSIS OF FRESH WATER USING Ge(Li) GAMMA SPECTROMETRY. Salbu, B. (Inst. for Atomenergi, Kjeller, Norway); Steinnes, E.; Pappas, A. C. Anal. Chem.; 47: No. 7, 1011-1016(Jun 1975).

A simple and rapid multielement method for the determination of trace elements in natural fresh water by purely instrumental neutron activation analysis is presented. The method which is based on Ge(Li) gamma spectrometry and computer evaluation of recorded data allows up to 40 elements to be determined without any pre-concentration steps. Data illustrating the precision of the method are given. The determination limit is approximately 1 mu g/l. or less for 30 of the elements concerned, provided "normal" fresh water concentrations of elements giving rise to the most prominent activities, e.g., Al, Cl, and Na are taken into account. Spectral interferences and other possible sources of systematic errors are discussed and shown to be of moderate importance in most cases. (auth)

5861 ELEMENTAL CONCENTRATIONS IN THE NATIONAL BUREAU OF STANDARDS' ENVIRONMENTAL COAL AND FLY ASH STANDARD REFERENCE MATERIALS. Ondov, J. M. (Univ. of Maryland, College Park); Zoller, W. H.; Olmez, I.; Aras, N. K.; Gordon, G. E.; Rancitelli, L. A.; Abel, K. H.; Filby, R. H.; Shah, K. R.; Ragaini, R. C. Anal. Chem.; 47: No. 7, 1102-1109(Jun 1975).

The four participating laboratories measured the concentrations of 37 elements in NBS standard coal (SRM 1632) and 41 in fly ash (SRM 1633). Most of the measurements were done by instrumental neutron activation analysis, which was done by each of the laboratories. In addition, one laboratory used instrumental photon activation analysis and another counted the natural radioactivity to determine concentrations of K, Th, and U. The results obtained are in good agreement with the values given by NBS for the twelve elements in each material for which both they and we have values. For most elements for which comparisons can be made, the interlaboratory dispersion of results obtained in this work is much less than was obtained in a recent round-robin analysis of these materials by many laboratories using a variety of techniques. Average concentrations for the 37 elements in the coal standard and 41 elements in the fly ash standard are presented for comparison with results that may be obtained by other laboratories. (auth)

5862 ANALYSIS OF PETROLEUM FOR TRACE METALS: LOSS OF MERCURY FROM POLYETHYLENE SAMPLE VIALS IN NEUTRON ACTIVATION ANALYSIS. Larson, J. O.; Tandeski, E. V. (Chevron Research Co., Richmond, CA). Anal. Chem.; 47: No. 7, 1159-1161(Jun 1975).

Absorption of energy during neutron irradiation is believed to trigger the formation of elemental mercury, which is then lost by diffusion as vapor. (auth)

5863 RAPID, INSTRUMENTAL NEUTRON ACTIVATION ANALYSIS FOR THE DETERMINATION OF URANIUM IN ENVIRONMENTAL MATRICES: EXCHANGE OF COMMENTS. Dams, R. (Inst. of Nuclear Sciences, Ghent); Weaver, J. N. Anal. Chem.; 47: No. 7, 1206-1207(Jun 1975).

5864 DETERMINATION OF RHODIUM IN PLATINUM-BEARING ORES BY NEUTRON ACTIVATION ANALYSIS. Steinnes, E. (Inst. for Atomenergi, Kjeller, Norway). Radiochem. Radioanal. Lett.; 21: No. 3-4, 233-239(10 May 1975).

Rhodium is determined in sulfide ore by a neutron activation method involving one pre-irradiation and one post-irradiation separation step. After acid decomposition of the sample, the interfering major elements Cu and Co are separated by anion exchange in 9M HCl. After removal of HCl and subsequent irradiation rhodium is fixed to an anion exchange column as a Rh-Sn-chloride complex. The method is based on 4.4 min ^{104m}Rh. Application to Cu–Ni sulfide matte is demonstrated. (auth)

5865 COMBINED DETERMINATION OF LIGHT AND HEAVY ELEMENT TRACES BY CHARGED PARTICLE ACTIVATION ANALYSIS. Petri, H.; Sastri, C. S. (Kernforschungsanlage, Juelich, Ger.). Radiochem. Radioanal. Lett.; 21: No. 3-4, 225-231(10 May 1975).

An aluminium sample, activated with He-3 ions to find its oxygen content, is remeasured at a later date with a Ge/Li-spectrometer to find its iron content. (auth)

5866 ANALYSIS OF MAGNESIUM BY PROMPT GAMMA RAYS INDUCED BY PROTONS. Demortier, G.; Delsate, P. (Facultes Univ., Namur, Belgium). Radiochem. Radioanal. Lett.; 21: No. 3-4, 219-224(10 May 1975).

The elemental analysis of magnesium by detection of γ rays emitted by low energy proton bombardment is explored. The intensities of 11 γ-rays from (p,γ) and (p,p'γ) reactions on ^{24}Mg, ^{25}Mg, ^{26}Mg produced by the bombardment with 1 to 3 MeV protons on thick targets of natural magnesium have been measured. The sensitivity of the method by detection of the 585 keV γ-ray from ^{25}Mg(p,p'γ)^{25}Mg may reach 100 ppm. for 15 min of bombardment with an incident proton beam of 1 μamp intensity. The application to the analysis of magnesium in biological samples is discussed. (auth)

5867 MULTIELEMENT ANALYSIS OF COAL AND COAL FLY ASH STANDARDS BY INSTRUMENTAL NEUTRON ACTIVATION ANALYSIS. Nadkarni, R. A. (Cornell Univ., Ithaca, NY). Radiochem. Radioanal. Lett.; 21: No. 3-4, 161-176(10 May 1975).

Instrumental neutron activation analysis was utilized for determining 39 major, minor, and trace elements in the N.B.S. standard reference materials coal: SRM-1632 and coal fly ash: SRM-1633. Recent literature on coal analysis is also reviewed. (auth)

5868 APPLICATIONS OF ACTIVATION ANALYSIS IN ARCHEOLOGY. Travesi, A. Energ. Nucl. (Madrid); 18: No. 90, 239-252(1974). (In Spanish).

As activation analysis is a nondestructive method for trace analysis, it has great interest for the archeologists. After a brief review of the techniques of activation analysis, the various applications to archeology are discussed. These include the study of ceramics and pottery, objects of glass, marble, and obsidian, and coins. The advantages of the use of scintillation detectors and semiconductor detectors are discussed. The problem of interpretation of data from activation analysis is considered. (JSR)

5869 NUCLEAR GEOPHYSICS METHODS FOR STUDYING THE MATERIAL COMPOSITION OF RARE METAL PEGMATITES. Kurginyan, S. E.; Petrova, M. G.; Tenyaev, V. G.; Shimelevich, M. I. (Moscow Geological Prospecting Inst.). Izv. Vyssh. Ucheb. Zaved., Geol. Razved.; No. 11, 65-68(Nov 1974). (In Russian).

Studies on the determination of cesium and beryllium in minerals indicated some of the advantages and disadvantages of nuclear laboratory methods. With high concentrations, the precision of nuclear methods is good. Methods developed for determining beryllium at high concentrations allow the use of much smaller samples (3-5 g) than did the earlier methods. With nuclear methods the sample is not destroyed by the analysis. This makes it possible to control the method and, by repeated measurements, to introduce corrections for systematic errors and to increase the precision of the analysis. Nondestruction of the sample makes it possible to use the sample repeatedly for other analytical studies. The greatest advantages of nuclear methods are rapidity and economy. Use of nuclear methods along with mineral-geological observations may explain some of the search criteria. For example, according to data obtained in large-scale mapping, in veins containing large-mass pollucite the cesium/rubidium ratio in lepidolite is 1:10 and in veins with finely dispersed non-industrial minerals, 1:4. The use of nuclear methods accelerates the development of geochemical criteria for searching for rare-metal pegmatite bodies containing large-mass pollucite. (tr-auth)

5870 INTERNAL-REFERENCE METHOD FOR DETERMINATION OF TRACE ELEMENTS IN ALUMINIUM BY NEUTRON ACTIVATION ANALYSIS. Chen, S. G.; Pung, T. C.; Tsai, H. T.; Wu, S. C. (Atomic Energy Council, Lung-Tan, Taiwan). Anal. Chim. Acta; 75: No. 1, 212-216(Mar 1975).

A rapid and precise analytical method for aluminum flow tubes by the internal-reference method of nondestructive neutron activation is proposed. There are no chemical separations, and chromium, copper, gallium, hafnium, cobalt, iron and scandium can be determined directly with good accuracy. Gold serves as an internal-reference element. (auth)

5871 NEUTRON ACTIVATION ANALYSIS FOR URANIUM IN FOSSIL BONES. Hamaguchi, H.; Kanno, H.; Kasai, M.; Kawashima, Y. (Tokyo Univ.). Anal. Chim. Acta; 75: No. 2, 445-448(Apr 1975).

This method for the determination of uranium is based on measurement of the activity of ^{239}Np, a decay product of ^{239}U. It in-

volves a radiochemical separation and the introduction of ^{237}Np carrier and ^{238}Np activity for the determination of radiochemical yield. A Ge(Li) detector connected to a 400-channel pulse-height analyser was used for the measurements of the radioactivities of ^{238}Np and ^{239}Np. It was found that U content in fossil bone at the ppM level could be determined with a precision of less than 5% by this method. (JGB)

5872 ACTIVATION ANALYSIS. Wicker, E. E. (United States Steel Corp., Monroeville, PA). pp 75-111 of Determination of Gaseous Elements in Metals. Melnick, L. M. (ed.). New York; John Wiley and Sons, Inc. (1974).

The discussion of activation analysis includes sections on: historical development, theory and principles of the method, equipment, neutron activation procedures and results, photon activation and charged-particle activation analyses. (64 references.) (JGB)

5873 NUCLEAR AND ION BEAM TECHNIQUES FOR SURFACE AND NEAR-SURFACE ANALYSES. Wolicki, E. A. (Naval Research Lab., Washington, DC). pp 673-727 of Determination of Gaseous Elements in Metals. Melnick, L. M. (ed.). New York; John Wiley and Sons, Inc. (1974).

Section titles include: introduction; charged-particle-activation analysis; and prompt-radiation analysis, which includes discussion on elastic scattering reactions, heavy-ion-induced x-rays, nuclear reactions, and nuclear resonance reactions. (106 references.) (JGB)

5874 RECOVERY OF ION-EXCHANGE RESINS AND PARTITION CHROMATOGRAPHIC SUPPORTS FROM LARGE SCALE RADIOCHEMICAL SEPARATION. Iyengar, G. V.; Samsahl, K. (Gesellschaft fuer Strahlen- und Umweltforschung mbH., Neuherberg/Munich, Ger.). J. Radioanal. Chem.; 25: No. 1, 47-57 (1975).

In order to reduce analytical expenses by the re-use of typical ion-exchange resins and partition chromatographic column supports, frequently used in large-scale routine analysis of biological samples in many radiochemical laboratories, the problem of their recovery was studied in column and batch operations. The difficulties encountered with respect to some elements are discussed in detail. (auth)

5875 DETERMINATION OF TIN IN INDIUM BY NEUTRON ACTIVATION WITH PRE-IRRADIATION SEPARATION. Jaskolska, H. (Inst. of Nuclear Research, Warsaw). J. Radioanal. Chem.; 25: No. 1, 89-97(1975).

Prior to irradiation tin is separated from a 1-g indium sample by iodide extraction followed by precipitation with $Pb(OH)_2$. The amounts of tin introduced as contaminant before pre-irradiation treatment do not exceed 0.1 μg in most cases. After irradiation in a thermal neutron flux of $5 \cdot 10^{13}$ n $\cdot$ cm^{-2} $\cdot$ sec^{-1} and suitable cooling the tin is extracted substoichiometrically with BPHA. The content of tin is determined on the basis of the 158 keV photopeak of ^{113m}Sn in the γ-spectrum. Other photopeaks appearing in the spectrum indicate the presence of various isotopes, it is then not possible to determine tin on the basis of counting ^{121}Sn β rays. The lower limit of determination is 0.2 ppM. (auth)

5876 DETERMINATION OF URANIUM IN SEA AND SURFACE WATERS BY NEUTRON ACTIVATION ANALYSIS AFTER ADSORPTION ON CHARCOAL. van der Sloot, H. A.; Massee, R.; Das, H. A. (Reactor Centrum Nederland, Petten, The Netherlands). J. Radioanal. Chem.; 25: No. 1, 99-105(1975).

The determination of uranium in sea and surface water samples after a preconcentration with activated charcoal by neutron activation analysis is described. (auth)

Chemical and Spectral Procedures

Refer also to abstracts 6451 and 7232.

5877 (BNWL-B-394) IN-SITU X-RAY FLUORESCENCE SYSTEM DESIGN. Rieck, H. G.; Kosorok, J. R.; Perkins, R. W.; Wogman, N. A. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Apr 1975. Contract AT(45-1)-1830. 13p. Dep. NTIS $5.45.

The objective of this study is to develop the capability for the real-time measurement of trace element and radionuclide pollutants in marine sediments. The technology discussed in this report permits the rapid mapping of the distribution of these pollutants in the surficial and bulk sediments. (auth)

5878 (CEA-CONF-2692) RECENT DEVELOPMENTS IN Pu ANALYSIS. Regnaud, F. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Service d'Etudes Analytiques). 1974. 13p. (In French). INIS.

From French-Spanish colloquium; Marcoule; Fontenay-aux-Roses, France (25 Apr 1974).

Analytical plutonium chemistry has developed during the last few years in three directions: high-precision analysis and analysis by atomic absorption and x-ray fluorescence. Oxidation–reduction titration methods give a precision of between 0.05 and 0.1% on the determination of plutonium in the metal and mixed oxides of fast neutron reactors. Pu(10^{-6} to 10^{-7}g) can be measured by atomic absorption. An x-ray fluorescence unit is used to analyze Pu and U in reprocessing solutions. (FR)

5879 (CEA-CONF-2836) PROFILE DETERMINATION BY SECONDARY EMISSION IN SEMICONDUCTOR AND INSULATING MATERIALS. Blanchard, B.; Monnier, J. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Chimie Appliquee). Jun 1974. 9p. (In French). INIS.

From 4th international congress AVISEM 74. Application of electronic and ionic processes; Toulouse, France (8 Oct 1974).

A methodology was developed, which enables profiles to be plotted quantitatively with a good resolution in depth. The ion emission rate was studied as well as the problem of interference. (FR)

5880 (CONF-750603-2) ENVIRONMENTAL AND FUEL MATERIALS ANALYSES BY MULTI-ELEMENT ISOTOPE DILUTION SPARK-SOURCE MASS SPECTROMETRY. Carter, J. A.; Donohue, D. L.; Franklin, J. C.; Stelzner, R. W. (Oak Ridge National Lab., Tenn. (USA)). 1975. 12p. Dep. NTIS $4.00.

From 9th annual conference on trace substances in environmental health; Columbia, Missouri, USA (10 Jun 1975).

The isotope dilution method of analysis was expanded to allow the addition of twenty or more enriched stable isotopes to a single sample. The method combines the survey capability of spark-source mass spectrometry with the accuracy and precision of isotope dilution techniques. The limit on the precision of analysis may well be the variability in response of the Ilford QII emulsion. The method was studied using National Bureau of Standards reference materials in order to determine the accuracy and precision of the method. The method was used to measure impurities in a variety of environmental samples at several concentration ranges. A microphotometer was interfaced with a mini-computer to permit rapid collection of data and subsequent concentration determinations. The data system and its operation will be discussed briefly. (auth)

5881 (NBL-274) RESULTS OF THE GENERAL ANALYTICAL EVALUATION PROGRAM FOR URANIUM HEXAFLUORIDE, PHASE I. Bingham, C. D.; Bracey, J. T. (Energy Research and Development Administration, New Brunswick, N. J. (USA). New Brunswick, Lab.). May 1975. 83p. Dep. NTIS $5.45.

Samples of uranium hexafluoride were submitted monthly to twenty-two laboratories in the USA and Europe for determination of percent UF_6 and the enrichment of uranium. Three samples were submitted each month over a twelve-month period. Participants were asked to report chemical data based upon their usual method for high-precision uranium analysis. Four materials, each of purity greater than 99.9 percent UF_6 were used. A majority of the participating laboratories fell within +–0.1 percent of the values assigned for the chemical purity. The enrichment of the uranium ranged from near-normal to approximately 1.7 percent ^{235}U. Most laboratory results fell within +–0.2 percent (relative) of the assigned enrichment values. There were wide variations in reported between-day precision. Only ten laboratories measured enrichment with sufficient precision to identify four different enrichments. Of these ten, four laboratories exhibited a bias with respect to the assigned value. This raises some question about the calibration control of mass spectrometric measurements. (auth)

5882 (NIM-1689) DETERMINATION, BY ATOMIC-ABSORPTION SPECTROPHOTOMETRY, OF ARSENIC, SELENIUM, TELLURIUM, ANTIMONY, AND BISMUTH ON ION-EXCHANGE RESINS. Dixon, K.; Mallett, R. C.; Kocaba, R. (National Inst. for Metallurgy, Johannesburg (South Africa)). 15 Mar 1975. 12p. Dep. NTIS (US Sales Only) $4.00.

A procedure for the analysis of the volatile elements antimony, arsenic, selenium, tellurium, and bismuth on ion-exchange resins is described. It is based on atomic-absorption measurement of a solution of the resin prepared by digestion with fuming nitric acid in a Teflon bomb. No interelement effects were recorded for the levels of noble metals and analyte elements tested. Precision and accuracy were within the required limit of approximately 10 percent of the true content. (auth)

5883 (Y-1986) SPARK SPECTROGRAPHIC CHARACTERIZATION OF URANIUM METAL BY PART SURFACE SENSITIZATION. King, H. G. (Oak Ridge Y-12 Plant, Tenn. (USA)). 29 May 1975. Contract W-7405-eng-26. 19p. Dep. NTIS $4.00.

Further studies of the in-situ spectrographic characterization of uranium metal resulted in changes in methodology that reduce

spectral background and improve the sensitivity of the method. The anode spot is sensitized by thermoelectrical bombardment from the ammonium bifluoride-packed cathode. Detection limits can be lowered by as much as twofold, and a more readable spectrogram is obtained. (auth)

5884 COMPARISON OF MASS SPECTROMETRY AND EMISSION SPECTROMETRY FOR THE ISOTOPIC ANALYSIS OF NITROGEN. Guiraud, G.; Buscarlet, L. A. (CEN de Cadarache, Saint-Paul-les-Durance, France). Int. J. Appl. Radiat. Isotop.; 26: No. 4, 187-193(Apr 1975). (In French).

In spite of its advantages over mass spectrometry, optical spectroscopy has not been much developed for isotopic analysis of nitrogen owing to the inaccuracy of the measurements for low excess of ^{15}N. The new apparatus JASCO NIA-1 has been tested and the results obtained compared to those given by the mass spectrometer. A calibration curve linking the two sets of readings is proposed. To build up this calibration curve two ways are considered: the easier one consists in dividing the interval studied (excess from 0 to 30%) in three linear segments, the other one, more sophisticated, is to use a polynome of the fifth degree fitted to the whole interval. Under these conditions, the ^{15}N excess values found are in good agreement with the mass spectrometer values, the relative error being under 1%. However the readings of the optical analyzer apparatus cannot be trusted for excesses lower than 0.2%. (auth)

5885 FLUORIMETRIC DETERMINATION OF MOLYBDENUM WITH MORIN UNDER CONDITIONS OF DEEP COOLING (−196°C). Pilipenko, A. T.; Zhebentyaev, A. I.; Volkova, A. I. (Inst. of General and Inorganic Chemistry, Kiev). Ukr. Khim. Zh.; 41: No. 3, 260-262(Mar 1975). (In Russian).

A study was made of the optimal conditions for the formation of a fluorescing complex of molybdenum with morin under conditions of deep cooling (−196°C). The effect of ethanol (acetone) on the fluorescence intensity of the complex was investigated, and the solvation number (1.8) was determined. Fluorescence spectra of the complex were taken at −196 and +20°C. The sensitivity of the fluorescence determination of Mo with morin is 0.1 μg at −196°C, and 1.5 μg Mo in 1 ml of solution at 20°C. (tr-auth)

5886 USE OF METALLIC NIOBIUM AND TANTALUM AS ANODES IN POLAROGRAPHY. Kurbatov, D. I.; Obozhina, R. N. (Inst. of Chemistry, Sverdlovsk, USSR). Zh. Anal. Khim.; 30: No. 3, 613-615(Mar 1975). (In Russian).

The possibility has been shown of using anodes made of metallic niobium and tantalum in polarographic determination of niobium (V) and titanium(IV). The maximum current flow of niobium(V) and titanium(IV) is directly proportional to their concentration in the solution. (auth)

5887 THIAZOLYLAZO COMPOUNDS AS REAGENTS FOR URANIUM(VI). Gusev, S. I.; Agilov, V. A.; Shurova, L. M. (Perm Medical Inst., USSR). Zh. Anal. Khim.; 30: No. 3, 540-544(Mar 1975). (In Russian).

Complex formation of uranium(VI) has been studied with 9 azo derivatives of thiazole in aqueous solutions and with 4 derivatives in organic extracts. Optimal conditions for the complex formation and main analytical characteristics of the complexes have been determined. 2-(2-Thiazolylazo)-5-diethyl-m-aminophenol has proved to be the best reagent for photometric determination of uranium. (auth)

5888 DEVELOPMENT OF A METHOD OF STANDARD ADDITION FOR THE X-RAY SPECTRAL DETERMINATION OF MOLYBDENUM IN SOLUTION. Verkhovodov, P. A. Ukr. Khim. Zh.; 41: No. 3, 273-276(Mar 1975). (In Russian).

A study is made of a variant of the method of standard additions for the case where the ratio between the concentrations of the element to be determined and the ratio of intensity of the analytical line to the background intensity is nonlinear. (tr-auth)

5889 EFFECT OF A NUMBER OF ORGANIC OXYACIDS ON THE PHOTOMETRIC DETERMINATION OF ZIRCONIUM. Zolotukhin, V. K.; Gnatyshin, O. M.; Senchishin, E. I. (Lvov State Univ.). Ukr. Khim. Zh.; 41: No. 3, 287-289(Mar 1975). (In Russian).

A study is carried out of the effect of tartaric, citric, trihydroxyglutaric and malic acids on the results of the photometric determination of zirconium by means of xylenol orange, pyrocatechin violet and arsenazo III. Stability series are presented for tartrate, citrate, trihydroxyglutarate and malic complexes with zirconium in 0.5 and 1.5 N hydrochloric acid solutions, and also at a pH of 5.3. (tr-auth)

5890 DETERMINATION OF MOLYBDENUM BY ATOMIC ABSORPTION IN ACETYLENE–AIR FLAME. Begak, O. Yu. Zh. Anal. Khim.; 30: No. 3, 619-621(Mar 1975). (In Russian).

Optimal conditions have been found of determining molybdenum by atomic absorption in acetylene–air flame. The sensitivity is 0.5 μg/ml (313.3 nm), the absolute sensitivity is $7 \cdot 10^{-8}$ g, the limit of detection is $2.1 \cdot 10^{-7}$ g. The effect of additives of Na_2SO_4, K_2SO_4, $CaCl_2$, $BaCl_2$, $LaCl_3$, HCl, H_2SO_4, H_3PO_4, ethanol, acetone, and dimethyl sulfoxide on the sensitivity of determining molybdenum in aqueous solutions has been studied. It has been shown that the precision of determining molybdenum increases with acid concentration in the solution. (auth)

5891 SPECTROPHOTOMETRIC STUDY OF THE MOLYBDENUM(VI)-1-PYRROLIDINECARBODITHIOATE SYSTEM. Lee, A. P.; Boltz, D. F. (Wayne State Univ., Detroit). Anal. Lett.; 8: No. 5, 345-358(May 1975).

A spectrophotometric study of the molybdenum-1-pyrrolidinecarbodithioate complex has shown that the metal : ligand ratio is 1:2. Both molybdenum(VI) and molybdenum(V) form complexes with almost identical absorption spectra. The conditional extraction constant for the molybdenum(VI)-1-pyrrolidinecarbodithioate in chloroform system has been evaluated as 6.3×10^{16}. (auth)

5892 CATALYTIC-KINETIC DETERMINATION OF IODIDE, MANGANESE AND MOLYBDENUM WITH THE USE OF AN ABSORPTIOSTAT. Weisz, H.; Rothmaier, K. (Freiburg i. B. Univ.). Anal. Chim. Acta; 75: No. 1, 119-126(Mar 1975).

The kinetic-catalytic determination of several catalysts by use of an absorptiostatic method is described. The determination of iodide in the range 0.5-5.0 μg/45 ml is based on its catalytic action on the cerium (IV)-arsenic (III) reaction. The catalytic action of manganese (II) on the reaction of malachite green with periodate was used for its determination in the range 1-10 μg/45 ml. The determination of molybdenum(VI) in the range 10-100 μg/40 ml is based on its accelerating action on the oxidation with hydrogen peroxide. (NL)

5893 CATALYTIC-KINETIC FLOW METHOD ON PAPER. Determination of Molybdenum. Weisz, H.; Ludwig, H. (Freiburg i. B. Univ.). Anal. Chim. Acta; 75: No. 1, 181-187(Mar 1975).

A new catalytic-kinetic flow method is described, in which a capillary support, filter paper, serves as medium for the reaction as well as for the transport. The catalyst to be determined and the two reactants migrate through a filter paper strip. On a suitable place of the filter paper itself, the concentration of one of the reactants is continuously measured. The example of the molybdenum-catalyzed reaction between hydrogen peroxide and iodide illustrates the procedure. The course of the reaction is followed potentiometrically with an iodide-selective electrode. (NL)

5894 INSTRUMENTAL METHOD FOR NITROGEN-15 AND TOTAL NITROGEN BY COMBINED SYSTEM OF MASS SPECTROMETER AND AUTOMATIC NITROGEN ANALYZER. Tsuji, O.; Masugi, M.; Kosai, Y. (Yanagimoto Manufacturing Co., Ltd., Kyoto). Anal. Biochem.; 65: No. 1-2, 19-25(12 May 1975).

A combined system of automatic nitrogen analyzer based on the principle of the Dumas method and a mass spectrometer for low molecular-weight compounds for measuring both total nitrogen and ^{15}N isotope in agricultural materials is described. Linearity and reproducibility of the mass spectrometric data were discussed and the coefficient of variation of ^{15}N concentration in ^{15}N-labeled ammonium sulfate and some agricultural materials was obtained within a range of 0.15 to 0.45 atom percent. The data with the proposed apparatus were compared with those of the conventional Rittenberg mass spectrometry and the new method was preferred because of its simplicity and reliability for total nitrogen. A memory effect in the Dumas combustion tube observed in the analysis of high-nitrogen samples was eliminated by combustion of nitrogen-free organic material added to the high-nitrogen sample in the sample boat. (auth)

5895 SOLID-STATE ISOTOPE DILUTION IN SPARK SOURCE MASS SPECTROMETRY. Jaworski, J. F.; Morrison, G. H. (Cornell Univ., Ithaca, NY). Anal. Chem.; 47: No. 7, 1173-1175 (Jun 1975).

Provided that good homogeneity is achieved in mixing the solid isotopes with a powdered sample, percent error and RSD on the order of 5 percent are obtained. This compares favorably with existing isotope dilution methods involving chemical equilibration. (auth)

5896 GRAVIMETRIC ESTIMATION OF BERYLLIUM AS BENZIDINE FLUOROBERYLLATE. Ghosh, T. K. (University Coll. of Science, Calcutta). Curr. Sci. (India); 44: No. 9, 307-308(5 May 1975).

A method for estimating beryllium in the presence of other

ions without separation is given. Beryllium is precipitated as benzidine fluoroberyllate. (LK)

5897 QUANTITATIVE PREPARATION OF SULFUR DIOXIDE, FOR $^{34}S/^{32}S$ ANALYSES, FROM SULFIDES BY COMBUSTION WITH CUPROUS OXIDE. Robinson, B. W.; Kusakabe, M. (Inst. of Nuclear Sciences, Lower Hutt, New Zealand). Anal. Chem.; 47: No. 7, 1179-1181(Jun 1975).

Pure cuprous oxide is easily prepared from Analar cupric oxide. For sulfide oxidation, it provides complete yields of SO_2 and low PO_2 conditions which inhibit SO_3 and sulfate formation. (auth)

5898 PRINCIPLES AND TECHNIQUES OF ELECTRON MICROSCOPY. Biological Applications. Volume V. Hayat, M. A. (ed.). New York; Van Nostrand Reinhold Company (1975). 263p. $19.95.

The book is comprised of five chapters: quantitative mapping with the electron microscope; photographic aspects of electron microscopy; environmental devices in electron microscopy; optical diffractometry; and the analytical electron microscope, EMMA-4. (LK)

5899 DETERMINATION OF THE SPECIFIC ACTIVITY OF SULFUR-35 IN AQUEOUS SULFATE SOLUTION USING AN ION-SELECTIVE ELECTRODE. Barry, E. F.; Butler, R. A.; Lavrakas, V. (Lowell Technological Inst., MA). Radiochem. Radioanal. Lett.; 21: No. 3-4, 105-113(10 May 1975).

The specific activities of ^{35}S in aqueous sulfate solutions were found using a sulfate ion selective electrode first described by Mohan and Rechnitz. Specific activities of the solutions were found to vary from 40 to 98% with a relative error of 8.0% or less. (auth)

5900 DETERMINATION OF SELENIUM IN WATER ON THE PPB LEVEL BY COPRECIPITATION AND ENERGY DISPERSIVE X-RAY SPECTROMETRY Pradzynski, A. H.; Henry, R. E.; Stewart, J. L. S. (Univ. of Texas, Austin). Radiochem. Radioanal. Lett.; 21: No. 5, 277-285(24 May 1975).

Using coprecipitation and energy dispersive x-ray fluorescence spectroscopy, 0.6 to 50 ppB levels of selenium were determined in fresh water in the presence of transition elements. The relative speed and economy of this method makes it suitable for application in environmental monitoring. (auth)

5901 SEPARATE DETERMINATION OF A NUMBER OF LANTHANIDE ELEMENTS IN THE PRESENCE OF EACH OTHER BY A COMPLEXIOMETRIC METHOD OF AMPEROMETRIC TITRATION. Zhdanov, A. K.; Markhabaev, I. A. (Tashkent State Univ.). Uzb. Khim. Zh.; No. 3, 21-24(1973). (In Russian).

A description is given of a new variant for the separate determination of mixtures of rare earth elements, whose pH differs by at least 2.7 pH units, by successive amperometric titration with complexone III on a unit having a rotating tantalum electrode at a potential of +1.1 volts without the use of buffers. The current strength was measured by a mirror galvanometer of the M-17 type. The method is based on regulating the pH of the sample to be analyzed before titration by means of a 0.5 M sodium acetate solution. Before carrying out the titration a determination was made of how much the pH of the initial solution is lowered on adding an equivalent amount of complexone to tie up the first component, and of how much the acidity affects the accuracy of the lanthanide determination. The required amount of acetate was established by means of pH meter LPU-01. On attaining the necessary value of pH, the first component was titrated, after which the pH was increased to 4 or 5 by adding 0.2 to 0.4 grams of sodium acetate, and the second component was titrated. The equivalence point was found by a generally accepted graphical method. (SJR)

5902 ATOMIC ABSORPTION SPECTROMETRY. Pinta, M. (ed.). New York; Halstead Press (1975). 438p. $95.00.

Translation of Vol. 2 of Spectrometrie d'absorption atomique; published under title, Application a l'analyse chimique.

A comprehensive review of the theory, techniques, and instrumentation of atomic absorption spectrometry and its application is presented in a compilation of 16 articles. The topics discussed are basic concepts of spectroscopy and principles of atomic absorption, instrumentation, radiation sources and atomizers, interference, and determination of optimal analytical conditions. The application of this method to the analysis of rocks and soils, ores, water, vegetable matter, biochemistry and toxicology, petroleum products, metals and alloys, nuclear energy, and civil engineering is covered in separate chapters. Indirect methods and minor applications are also discussed. The chapters on application give many specific techniques. An extensive bibliography is appended. A separate abstract was prepared for one chapter. (JSR)

For an abstract of an individual chapter see: 5903.

5903 NUCLEAR ENERGY. Baudin, G.; Normand, J. pp 336-346 of Atomic Absorption Spectrometry. Pinta, M. (Ed.). New York; Halstead Press (1975).

Specific methods are given for the use of atomic absorption spectroscopy in the determination of impurities in U, determination of alloying elements Fe and Al in U, and determination of Mo in U-Mo alloys. As examples of the use of atomic absorption spectroscopy in the analysis of shielding materials, methods are given for the determination of Cu and Mo in Zr, analysis of Mg, determination of Ca and Cu in Zr, and determination of Li in Al alloys. (JSR)

5904 SYSTEMATIC ERROR IN TIN ORE ASSAY BY MOESSBAUER SPECTROMETRY. Pella, P. A.; DeVoe, J. R. (National Bureau of Standards, Washington, DC). J. Radioanal. Chem.; 25: No. 1, 185-188(1975).

Nondestructive tin ore analysis is described for SnO_2 by Moessbauer spectrometry. The systematic error is discussed. (auth)

5905 IMPROVEMENT OF A MASS SPECTROMETER FOR MEASUREMENT OF THE ISOTOPIC CONTENT OF SOLID SAMPLES BY STANDARD-SAMPLE METHOD. Kaviladze, M. Sh.; Melashvili, T. A.; Lekveishvile, D. N.; Kviria, M. S. (Tbilisi State Univ., USSR). Soobshch. Akad. Nauk Gruz. SSR; 77: No. 3, 581-584(Mar 1975). (In Russian).

A method of relative isotopic measurement of solid phase samples is proposed. The precision of this method is close to the method developed in the laboratory of H. Urey for elements that, under normal conditions, form various gas combinations. (auth)

5906 HELIUM ISOTOPE AND RARE GAS OCEANOLOGY. Jenkins, W. J. Hamilton, Ont.; McMaster Univ. (1974). vp. National Library of Canada, Ottawa.

Thesis (Ph. D.).

The isotopic composition and concentration of the dissolved helium have been measured in over 250 samples of Atlantic and Pacific seawater. The helium isotope ratios were measured using a double collection "static" mass spectrometer specifically designed and constructed for this purpose. The helium and neon contents of 118 of these samples were determined using the isotope dilution technique, and the helium contents of the remaining samples were determined by peak-height comparison with standard air aliquots. Krypton and xenon concentrations were measured by isotope dilution for the Pacific samples. Two sources of excess nonatmospheric ^3He are discerned in the Atlantic Ocean: a primordial component and a component produced by in situ decay of bomb-produced tritium. The former component occurs in three distinct features; two emanating from the south at 1000 m and greater than 4000 m depths, and one emanating from the north at about 3000 m depth. The spatial properties of these features are studied in the framework of simple models. The latter, of "tritiugenic" component is coupled with tritium concentrations measured by others to obtain Tritium-helium Ages, the characteristics of which are compared with hydrographic features. For example, the spreading velocity of the Mediterranean Water is determined to be $\simeq 1.5$ cm sec^{-1} in the North-Western Atlantic. The helium and neon concentrations measured in Atlantic Waters indicate that significant variations occur for helium contents, both as a function of depth and latitude. The Antarctic Bottom Water appears to be a source of excess helium. In the Pacific, the distribution of excess ^3He is shown to be consistent with injection of primordial ^3He into the Deep and Bottom Waters from the East Pacific Rise. The characteristic mid-depth maximum seen in the helium isotope ratio anomaly profiles is shown to be a circulational feature. Upper and lower limits on the amount of excess nonatmospheric ^4He are set at 5.5 and 2.6% respectively. Application of a simple one-dimensional diffusive-advective model indicate an upward flux of 6 ± 2 and $1.1 \pm 0.5 \times 10^6$ atoms/cm^2/sec for ^3He and ^4He respectively. Pacific seawater is, on the average, 16 and 31% supersaturated in krypton and xenon respectively. Although there is no known process that is capable of such enrichments, the spatial distribution of the krypton and xenon concentrations indicate that a significant amount of the enrichment occurs in situ in Pacific Deep Waters. (Diss. Abstr. Int., B)

Radiometric and Radiochemical Procedures

Refer also to abstracts 6501, 6540, 6544, 6825, 6916, and 7382.

5907 (AERE-C/M-37) USE OF T.T.A. FOR THE ESTIMATION OF PLUTONIUM IN TRACER QUANTITIES. Walton,

G. N. (UKAEA Research Group, Harwell. Atomic Energy Research Establishment). Sep 1949. 27p. Dep. NTIS (US Sales Only) $4.50.

Existing available information about T.T.A. and its use is summarized. An analytical method is described for the estimation of the total plutonium in a sample under certain conditions; and for the estimation of tetravalent plutonium, as distinct from the tri- or hexavalent states. Results for the procedures used are quoted and the equilibria involved are discussed. (auth)

5908 (ANL-75-24) RADIOCHEMICAL PROCEDURES AND TECHNIQUES. Flynn, K. (comp.). (Argonne National Lab., Ill. (USA)). Apr 1975. Contract W-31-109-Eng-38. 71p. Dep. NTIS $5.45.

A summary is presented of the radiochemical procedures and techniques currently in use by the Chemistry Division Nuclear Chemistry Group at Argonne National Laboratory for the analysis of radioactive samples. (auth)

5909 (CEA-CONF-2738) ON-LINE ANALYSIS AND PROCESS CONTROL AT THE SERVICE ATELIER-PILOTE IN MARCOULE. Dedaldechamp, P. (CEA Centre de Marcoule, 30 - Bagnols-sur-Ceze (France). Dept. de Genie Radioactif). 1974. 7p. (In French). INIS.

From French-Spanish colloquium; Marcoule; Fontenay-aux-Roses, France (25 Apr 1974).

At the Service Atelier Pilote in Marcoule, a program was developed for setting up and developing on-line analyzers and for automatic process control. The analyzers carry out continuous radiochemical determinations (alpha detection, γ detection, detection of rare gases) and physical measurements (γ absorption meter, conductivity meter). Automatic control by computer has already been applied to feeding the vitrification pot and control of a pulsed column. Tests are proceeding to ensure the complete automatic control of an extraction cycle. (FR)

5910 (RD/B/N-3234) ASSESSMENT OF METHODS FOR THE DETECTION AND SPATIAL LOCALIZATION OF RADIOACTIVE PARTICLES. Darley, P. J. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Nov 1974. 37p. Dep. NTIS (US Sales Only) $5.00.

Recent progress in the development of methods for the spatial localization of individual radioactive particles is outlined with particular attention being given to the localization of β active particles in the respirable size range. One of the techniques described, which employs a scintillation detector coupled to an image intensifier, would appear to have considerable development potential as a rapid routine method for monitoring for radioactive particulates. The new technique of scanning electron microscope autoradiography has however the distinct advantage that it allows valuable additional information on the particle size, composition, activity and energy of β emission to be obtained, and this method has been selected as the preferred route for extending the present single particle analysis capability of the Health Physics Research Section. (auth)

5911 (SGAE-2368) ELECTROLYTIC PREPARATION OF CALIBRATION SAMPLES IN ALPHA SPECTROMETRY. Irlweck, K.; Sorantin, H. (Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf. Inst. fuer Strahlenschutz). Nov 1974. 21p. (In German). Dep. NTIS (US Sales Only) $4.25.

The most important electrolysis methods described in the literature for the preparation of calibration samples are compiled. Studies on the completeness of the electrolytic deposition of ^{239}Pu showed that quantitative deposition was obtained after 30 min. The preparation of U, Np, and Am samples by electrolytic deposition was also reported. The results of calibration measurements using U solutions are shown graphically. It was concluded that the electrolysis method is suitable for the preparation of samples for α spectrometry studies. (JSR)

5912 (Y-DD-173) URANIUM IN VIVO SPECTROMETRY. Scott, L. M.; West, C. M. (Oak Ridge Y-12 Plant, Tenn. (USA)). 1975. Contract W-7405-eng-26. 36p. (CONF-750445-4). Dep. NTIS $5.00.

From conference on occupational health experience with uranium; Arlington, Virginia, USA (28 Apr 1975).

Uranium in vivo spectrometry has developed over the last 18 years into a successful technique to monitor for lung deposits of depleted and enriched uranium. Different detector systems and shielding requirements are discussed. Methods of estimating subject background are described. Major problems are external surface contamination, isotopic distribution, and ^{238}U parent-daughter relationships. (auth)

5913 DETERMINATION OF RADIOCHEMICAL PURITY OF RADIOMERCURY BY PAPER CHROMATOGRAPHY. Ebihara, H.; Kamioki, H. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). Jap. Anal.; 23: No. 10, 1221-1225(Oct 1974). (In Japanese).

The paper chromatographic determination of radioactive mercurous and silver ions in radiomercuric solutions was developed as a method for examination of radiochemical purity of radiomercury product. Since the possible impurities in the commercial radiomercuric solution product were mercurous and silver ions on the preliminary tests, the synthetic sample solution was made of $^{197}Hg^{2+}$ (including $^{203}Hg^{2+}$), $^{197}Hg_2^{2+}$ (including $^{203}Hg_2^{2+}$) and $^{110m}Ag^{+}$ ions in 1 N nitric acid or 1 N hydrochloric acid. Each sample solution contained ~1 mCi of radioactive metal ions and ~1 μg of non-radioactive carrier ions in 1 ml of 1 N acids. Samples were spotted with a micropipette at 5 cm apart from the lower end of the filter paper. The sample was developed by the usual ascending technique for about 4 hours in a glass developing vessel taking special care of shielding the light to suppress the disproportionation reaction of mercurous acetate. Immediately after the development, saturated ammonium sulfide solution was sprayed on the paper to avoid volatilization of mercury, then dried at room temperature. For radioactivity measurement of the chromatograms, a radio paper chromatogram scanner was used to estimate the R_f values, and an automatic GM-counting system was used for quantitative analysis of the separated ions by cutting the paper in strips of 5 mm width. Separation of mercuric and mercurous ions was well completed by using a mixed solution of 99.5% acetic acid-65% nitric acid-water (volume ratio of 150:3:5) as a developing solvent, whereas mercurous and silver ions were not separated in this solvent. The R_f values for mercuric, mercurous, and silver ions were 0.49, 0.14, and 0.14, respectively. Separation of mercury and silver ions was attained by using a mixed solution of the same kind but different composition of 15:1:4(v/v). The R_f values for silver, mercurous and mercuric ions were 0.52, 0.73, and 0.79, respectively. On the contrary, separation of mercurous and mercuric ions was not so much clear-cut in this developing solvent. Consequently, determination of radiochemical purity of radiomercuric solution was accomplished by applying above two developing solvents for a test solution simultaneously. About 6 hours were required to determine the two impurities by the method mentioned above including radioactivity scanning. This method can insure the radiochemical purity of the commercial radiomercury product to be more than 99%. (auth)

5914 STUDIES ON DETERMINATION OF ^{137}Cs BY LOW BACKGROUND BETA-RAY SPECTROMETER. Beta-Ray Spectrometry of ^{137}Cs, Impure ^{40}K and ^{87}Rb in Radiochemical Analysis of ^{137}Cs in Sea Water. Kamada, H. (National Inst. of Radiological Sciences, Chiba (Japan)). Radioisotopes (Tokyo); 23: No. 12, 686-692(Dec 1974). (In Japanese).

In the radiochemical determination of ^{137}Cs in the seawater sample, it is expected that impurities such as ^{40}K and ^{87}Rd coprecipitate with ^{137}Cs in relation to the employed chemical separation. In order to determine ^{137}Cs in the sample as accurately as possible, the low background β-ray spectrometer was utilized. The β-ray spectrum, which was measured by the low background β-ray spectrometer on the counting sample after chemical separation, was identified by the stripping method using the standard sample of interested radionuclide and the radioactivity of ^{137}Cs was determined spectrometrically by the weighted least-squares analysis. The obtained results by the conventional method using a low background GM counter after chemical separation showed 1.15 to 1.9 times as much as those from the low background β-ray spectrometer. It was found that overestimation from the conventional counter after chemical separation, $Ni_2Fe(CN)_6$-AMP-H_2PtCl_6 method, was arisen by ^{87}Rb. And the net radioactivity of ^{137}Cs could be determined by the β-ray spectrometry without completely removing impure ^{87}Rb from the counting sample. (auth)

5915 X-RAY FLUORESCENCE DETERMINATION OF THE NOBLE AND NON-FERROUS METALS IN POWDERED TECHNOLOGICAL PRODUCTS. Verkhovodov, P. A.; Molodetskaya, N. E.; Konev, A. V. (Sibirian State Design and Scientific-Research Inst. of Non-Ferrous Metallurgy, Krasnoyarsk, USSR). Zh. Anal. Khim.; 30: No. 3, 472-478(Mar 1975). (In Russian).

An x-ray fluorescence procedure was developed for determining the noble and non-ferrous metals (Ru, Rh, Te, Ag, Pd, Ir, Au, Pt, Pb, Se) in powdered technological products. At concentrations 10 times as much as the detection limits, the coefficient of variation is 3 to 5%. The procedure accuracy and precision and the detection limits obtained are not worse than those of chemical methods of the analysis of the same materials. (auth)

5916 OXYGEN FLASK COMBUSTION OF PLANT TISSUES FOR ^{14}C ACTIVITY MEASUREMENTS. Hanker, I.; Taimr, L.; Kudelova, A. (Ustav Ochrany Rostlin, Prague). Radioisotopy.; 16: No. 2, 181-194(Apr 1975). (In Czech).

Samples of plant material were combusted in oxygen atmosphere in the apparatus Micro-Mat BF 5010. The quantitative combustion of the sample and reproducibility of measurement results was confirmed by visual observation and liquid scintillation counting of the ^{14}C activity. (auth)

5917 SURFACE ANALYSIS WITH HEAVY ION INDUCED AUGER ELECTRONS: BASIC PROPERTIES OF A NEW METHOD FOR MATERIALS SCIENCES. Greeneveld, K. O.; Mann, R.; Meckbach, W.; Spohr, R. (Univ., Frankfurt am Main). Vacuum; 25: No. 1, 9-12(Jan 1975).

Heavy ion induced Auger electron spectroscopy is presented as a new tool for surface analysis. In contrast to conventional Auger electron spectroscopy using electron excitation, the technique offers the advantage of selective excitation of specific impurity elements present in a solid matrix by choosing a proper value of projectile mass and projectile energy. The technique is characterized by very fast rising cross sections at threshold. The cross sections can be very large in comparison to electron excitation. Due to the high energy loss of heavy ions at the energies applied, the projectiles are probing a very thin surface layer of the sample. Another benefit of heavy ion excitation is the possibility of simultaneous detection of back scattered heavy ions as well as the possibility for detection of ultra soft x-rays. In this way three complementary techniques are available simultaneously for mutual comparison. (auth)

5918 THE USE OF AUGER AND CONVERSION-ELECTRONS FOR THE DETECTION OF EMITTING RADIONUCLIDES: CHROMATOGRAPHIC QUALITY CONTROL OF RADIOPHARMACEUTICALS. Wenzel, M.; Wahid, A. A. (Freie Univ., Berlin). Int. J. Appl. Radiat. Isotop.; 26: No. 3, 119-123(Mar 1975).

The extremely weak β-particles produced by the energy-transfer of the γ-rays of radionuclides on orbital electrons (Auger- and/or conversion electrons) can be measured by a windowless proportional counter with external field. This effect can be used to detect γ-emitting radioisotopes on chromatograms with a reasonable efficiency and a better resolution of narrow spots than by detecting their γ rays and x rays with a NaI detector with collimator. Therefore the purity of compounds labelled with γ emitters (^{125}I, ^{99m}Tc, ^{75}Se) on one- or two-dimensional chromatograms can be checked with scanning equipment used for tritium. (auth)

5919 ELECTRODEPOSITION AND DETERMINATION OF RADIUM BY ISOTOPE DILUTION IN SEA WATER AND IN SEDIMENTS SIMULTANEOUSLY WITH OTHER NATURAL RADIONUCLIDES. Koide, M.; Bruland, K. W. (Scripps Inst. of Oceanography, La Jolla, CA). Anal. Chim. Acta; 75: No. 1, 1-19 (Mar 1975).

An isotopic dilution method has been developed for the determination of ^{226}Ra and ^{228}Ra in seawater and sediments with ^{223}Ra as a yield tracer. An alternative procedure, which obviates the need for ^{223}Ra, is demonstrated for sediments by the assay of ^{224}Ra and ^{228}Th that occur naturally in sediments. In addition, a direct method for β-counting ^{228}Ra-^{228}Ac is proposed. Radium, polonium, thorium, and uranium isotopes and ^{210}Pb are coprecipitated from seawater with aluminum phosphate carrier. The radium and ^{210}Pb are coprecipitated with lead nitrate in sediment leachings. All radium procedures utilize identical chemical isolation and the cathodic electrodeposition of radium. Subsequently, the α-radiation emitted by ^{226}Ra, ^{223}Ra and ^{224}Ra is determined by pulse-height analysis; the ^{228}Ra-^{228}Ac and ^{210}Pb-^{210}Bi are measured by low background anticoincidence β-counting techniques. This method was used for samples containing 10^{-11}-0.5×10^{-12}g of ^{226}Ra and 10^{-13}-10^{-15} g of ^{228}Ra and gave a precision of 3-6% and 5-10% respectively, even though radium levels an order of magnitude less can be measured. The ^{226}Ra method is applicable to all environmental samples, whereas ^{228}Ra determinations are limited to applications where the $^{228}Ra/^{226}Ra$ activity ratio is greater than 0.1. This method is especially attractive for studies of parent-daughter disequilibria. (INIS)

5920 DETERMINATION OF SILVER IN ROCKS BY A STOICHIOMETRIC RADIOREAGENT RADIOISOTOPE DILUTION TECHNIQUE. Lillie, E. G. (United States Geological Survey, Reston, VA). Anal. Chim. Acta; 75: No. 1, 21-30(Mar 1975).

A rapid procedure for the routine determination of nanogram amounts of silver in rocks is described. After dissolution of the sample with a hydrofluoric–nitric–perchloric acid mixture in the presence of ^{110}Ag tracer, the silver is separated by extraction as the dithizonate into xylene and back-extracted into dilute hydrochloric acid. After evaporation and removal of the hydrochloric acid, the silver is taken up in an acetic acid-sodium tartrate buffer solution and reacted with a constant amount of radioactively labelled iodide. The silver iodide formed is isolated by extraction into amyl alcohol, and silver is determined by the ratio of the counting rate of the iodide to that of the silver in the silver iodide complex. Results of the analyses of several U. S. Geological Survey standard rocks are given. (INIS)

5921 EXPERIENCES WITH AUTOMATED X-RAY FLUORESCENCE SPECTROMETRY IN THE ANALYSIS OF REFRACTORY METALS. Ortner, H. M.; Lassner, E.; Hertroys, P. (Metallwerk Plansee AG, Reutle/Tyrol, Austria). X-Ray Spectrom.; 4: No. 1, 2-10(Jan 1975).

From 10th spectrometry conference; The Hague, Netherlands (8 May 1974).

This paper reflects three years' experience on the part of two of the authors with the Philips PW 1220/C X-ray fluorescence spectrometer in combination with the Philips software packages 'X-ray 21' and 'X-ray 10' for the analysis of molybdenum, tungsten and their alloys. Of the ten analysis programs developed, three are discussed in detail. They embrace the determination of main constituents in the region of 100% as well as the determination of traces in the ppm range after trace-matrix separation. For trace analysis the standard software had to be modified in order to measure several blanks and standards and to overcome other shortcomings in the original program. The arithmetical means of blanks and standards are used for the calculation of linear calibration functions. This new, more versatile X-ray 10 software package extends the applicability of the standard X-ray 10 system to trace analysis. It also proved advantageous for the analysis of minor constituents in aqueous solutions. (auth)

5922 DETERMINATION OF ^{14}C-LABELED PLASMA L + alpha-ALANINE SPECIFIC RADIOACTIVITY. Reilly, P. E. B. (Univ. of Liverpool). Anal. Biochem.; 65: No. 1-2, 298-304 (12 May 1975).

A method is described, which enables the specific radioactivity of ^{14}C-labeled L + alpha-alanine in plasma to be determined. Plasma alanine concentration is determined spectrophotometrically using alanine dehydrogenase. In a separate procedure, this enzyme is also used to convert ^{14}C labeled alanine and added carrier alanine, to pyruvate. The phenylhydrazone derivative of the pyruvate is then prepared and assayed for radioactivity after crystallization to constant specific radioactivity. A maximum error of 1.5 percent for any one specific radioactivity determination was found. (auth)

5923 DOUBLE LABEL COUNTING OF METAL NUCLIDES WITH ^{3}H OR ^{14}C BY LIQUID SCINTILLATION COUNTING. Cousins, R. J.; Wynveen, R. A.; Squibb, K. S.; Richards, M. P. (Rutgers Univ., New Brunswick, NJ). Anal. Biochem.; 65: No. 1-2, 412-417(12 May 1975).

The photon spectra and counting efficiencies of ^{109}Cd, ^{115}/sup m/Cd, ^{203}Hg, and ^{65}Zn obtained by liquid scintillation counting are presented. Although these nuclides undergo multiple modes of radioactive transformation, the photon energies are sufficiently grouped within a certain energy range to allow simultaneous counting with either ^{3}H or ^{14}C in double label experiments. The simultaneous assay of ^{3}H with ^{115}/sup m/Cd and ^{14}C with ^{65}Zn was demonstrated with rat liver cytosol fractionated by gel filtration chromatography. (auth)

5924 STRIP CHART COUNTING OF ^{32}P IN GEL ELECTROPHORESIS STRIPS. Rushizky, G. W.; Mozejko, J. H. (National Inst. of Health, Bethesda, MD). Anal. Biochem.; 65: No. 1-2, 540-542(12 May 1975).

In spite of the low recovery, SCC offers several advantages over scintillation counting. Thus, most ^{32}P labeling produces highly active samples with which internal standards relating SCC to Cherenkov counting are readily obtained. Furthermore, SCC is nondestructive, requires no x-ray films, and may be routinely used for the rapid scanning of many gels. Strip chart counting calls for more than about 0.1 nCi of ^{32}P per band. If this requirement is met, the procedure is useful for the rapid (3 to 4 gels/h) evaluation of ^{32}P labeled materials, such as partial enzymatic digests of nucleic acids. (auth)

5925 COMPUTERIZED LIQUID SCINTILLATION COUNTING DATA MANAGEMENT. I. Time Sequence for Decay Correction: a Key for Data Storage and Retrieval. Aaron, C. S.; Lee, W. R. (Louisiana State Univ., Baton Rouge). Anal. Biochem.; 65: No. 1-2, 573-577(12 May 1975).

A new system of computerized liquid scintillation counting data management has been developed that has greatly facilitated the precise correction for radioactive decay in low-level tracer experiments where samples count over long periods of time. The data acquisition function is performed with a Packard Tri-

carb Model 3320 liquid scintillation spectrometer. Computing is done (time-sharing mode) on a DEC system 10 (DA10 processor) equipped with an RD10 swapping disk, 2RPO2 disk drives, and 64K words (36 bits) of main storage. (ERB)

5926 SIMPLE METHOD FOR THE DETERMINATION OF URANIUM IN SOILS BY TWO STAGE ION EXCHANGE. Baltakmens, T. (National Radiation Laboratory, Christchurch, New Zealand). Anal. Chem.; 47: No. 7, 1147-1149(Jun 1975).

This procedure, requiring only ordinary laboratory reagents and ion exchange resin, eliminates interference by other natural radionuclides. Recoveries of over 95 percent are obtained and the method is applicable to various types of soils. (auth)

5927 INFLUENCE OF THE CHEMICAL FORM OF RADIONUCLIDES ON THE SHAPE OF THE GAMMA-RAY SPECTRUM. de Bruin, M.; Korthoven, P. J. M. (Interuniversity Reactor Inst., Delft, Netherlands). Radiochem. Radioanal. Lett.; 21: No. 5, 287-292(24 May 1975).

The relation between the chemical form of a radioactive isotope and the shape of the γ spectrum is described. The relative sum peak area in a spectrum of ^{181}Hf is different for aqueous solutions with and without fluoride. (auth)

5928 CHERENKOV COUNTING EFFICIENCY OF ^{32}P INCREASE, USING ANTHRANILIC ACID OR QUININE AS A WAVELENGTH SHIFTER. Fric, F.; Finocchiaro, V. (Inst. of Experimental Biology and Ecology, Bratislava). Radiochem. Radioanal. Lett.; 21: No. 3-4, 205-210(10 May 1975).

Two new wavelength shifters (anthranilic acid, quinine) were studied from the point of view of their effect on the counting efficiency of ^{32}P in Cherenkov radioassay. In the presence of 10^{-3}M anthranilic acid, the counting efficiency increased from 47.2 to 58.4 per cent, in the case of quinine (2×10^{-3}M) from 47.2 to 54%. For colour quench correction, the channels-ratio quench-correction method was verified. The wavelength shifter can be used for the improvement of the counting efficiency of ^{32}P in the presence of coloured solutions, e.g., plant extracts. (auth)

5929 DETERMINATION OF STRONTIUM-90 AND STRONTIUM-89 BY CHERENKOV AND LIQUID-SCINTILLATION COUNTING. Randolph, R. B. (USAEC Idaho Operations Offices, Idaho Falls). Int. J. Appl. Radiat. Isotop.; 26: No. 1, 9-16(Jan 1975).

A practical procedure is described for the determination of ^{90}Sr and ^{89}Sr in mixtures, utilizing sequential Cherenkov and liquid-scintillation counting. The two purely β-particle emitting nuclides, freshly separated from ^{90}Y, are first counted for ^{89}Sr Cherenkov radiation, taking advantage of the large differences in maximum β decay energies, i.e., 1463 keV for ^{89}Sr versus 546 keV for ^{90}Sr. Scintillation solution is then added, and the sample is recounted for ^{90}Sr. Correction for the overlap of ^{89}Sr and/or ingrown ^{90}Y into the ^{90}Sr spectral region is made by dual radionuclide counting with external-standard ratio techniques. Reasonably accurate results have been obtained for synthetic samples having ratios of $^{90}Sr/^{89}Sr$ ranging from 20/1 to 1/20, if counting is completed within 24 hr. (auth)

5930 DETERMINATION OF THE BITUMEN CONTENT IN ASPHALT CONCRETE USING A NEUTRON REFLECTION METHOD. Buczko, M.; Dezso, Z.; Csikai, J. (Kossuth Univ., Debrecen, Hungary). J. Radioanal. Chem.; 25: No. 1, 179-183 (1975).

A neutron physical method for the fast, nondestructive determination of the bitumen content in asphalt concrete has been developed. The determination is performed on cylindrical asphalt concrete samples containing desiccated rubble matrix. Using samples of ~1000 g and measuring times of 20 min, the reproducibility of the bitumen determination is ±0.15 w%, the sensitivity is $3 \cdot 10^{-3}$ g/g. (auth)

5931 ANALYSIS BY DIRECT OBSERVATION OF NUCLEAR REACTIONS OF OXYGEN AND CARBON IN THE VICINITY OF THE SURFACE OF BORON SAMPLES. Thomas, J. P.; Engerran, J.; Tousset, J. (Institut de Physique Nucleaire, Villeurbanne, France). J. Radioanal. Chem.; 25: No. 1, 163-177(1975). (In French).

Ion-beam surface analysis of light elements such as oxygen and carbon in light matrices (boron in our case) is mainly subject to matrix interferences. Using a telescope detection system it is shown that (d,p) reaction for carbon and proton backscattering for oxygen are able to lead to concentration profiles on the first microns of bulk boron samples. Data processing is described and analytical results are shown, making evidence of the purification obtained using electronic bombardment furnace. Comparing with other physical methods of analysis, limitation and improvements on this procedure are discussed. (auth)

5932 JANE: AN EASY TO HANDLE COMPUTER PROGRAM FOR DIFFERENT LEVELS OF QUALITATIVE AND QUANTITATIVE GAMMA-RAY SPECTRA ANALYSIS. Schubiger, P. A.; Chakraborty, S.; Wyttenbach, A.; Blaser, W. (Swiss Federal Inst. for Reactor Research, Wuerenligen). J. Radioanal. Chem.; 25: No. 1, 141-154(1975).

A program for a large computer coded in FORTRAN IV is described. It has been tested thoroughly on an IBM 370/155, a CDC 6400/6500 and a CDC 3300. The program consists of nine versions which can perform most aspects of the evaluation of γ-spectra, from the simple smoothing of the raw data and detection of the peaks, up to a complete qualitative and quantitative analysis of unknown samples. A new kind of two-step fitting for the calculation of the peak parameters is presented. It delivers sufficiently precise parameters for the qualitative analysis after a short first step, and if so desired, very precise ones for a quantitative analysis in the second step. Both steps together are as fast as the common one step approach. Its special features are its reliability and its easy applicability to many different purposes and equipments. (auth)

5933 RADIORELEASE DETERMINATION OF MERCURY VAPOR IN AIR USING RADIOACTIVE KRYPTONATE OF SELENIUM SULFIDE. Naoum, M. M.; Tolgyessy, J.; Jesenak, V.; Klehr, E. H. (Slovak Technical Univ., Bratislava). J. Radioanal. Chem.; 25: No. 1, 129-140(1975).

Radioactive kryptonate of selenium sulfide is suggested for the determination of the concentration of mercury vapor in air. Selenium sulfide was applied as a coating to paper; upon the exposure to an atmosphere containing mercury vapor, a black color of mercuric sulfide and mercuric selenide developed. The fractional decrease in the radioactivity of the paper (related to the original specific activity) was found to be proportional to the concentration of mercury vapor and time of exposure. Other factors which can be controlled were found to be affecting the determination significantly. (auth)

5934 NEW POSSIBILITIES IN SUBSTOICHIOMETRIC SEPARATION. Shamaev, V. I.; Kolotov, V. P. (Inst. of Chemical Tech., Moscow). J. Radioanal. Chem.; 25: No. 1, 107-128(1975).

New equations were derived and new ways of the analytical procedures have been developed that allowed determinations to be carried out in cases when the conditions of the substoichiometric separations are not fulfilled. (auth)

5935 SPECTRAL OVERLAP METHOD FOR SELF MONITORING QUENCH CORRECTION IN DOUBLE ISOTOPE LIQUID SCINTILLATION COUNTING. Ayrey, G.; Evans, K. L. (Queen Elizabeth Coll., London). J. Radioanal. Chem.; 25: No. 1, 59-73(1975).

A method for quench correction of samples with double radioactive labelling is described. Each nuclide makes a contribution to the counting rate of three channels of a liquid scintillation counter. This channel overlap is an essential requirement of the calibration procedure rather than a limitation, and allows more freedom in the choice of counting conditions. After calibration with suitable standards the method will tolerate wide variations in the ratio of one isotope to the other extending to single label samples of either isotope. This is the outstanding advantage over the channel ratio method which requires a statistically significant counting rate for the higher energy isotope. The method takes advantage of the facilities offered by a computer which may be on line or remote. ^{14}C and tritium are used to demonstrate the utility of the method. (auth)

Separation Procedures

Refer also to abstracts 5984, 6075, 7814, and 8424.

5936 (MLM-2198, pp 32-45) SEPARATION CHEMISTRY. 10 Apr 1975.

In Mound Laboratory activities for the Division of Physical Research: July–December 1974.

The cubic Pu characteristic equation may be rewritten as a linear equation in logarithms. Processing of Cotter Concentrates (uranium mill by-product) for recovery of ^{230}Th and ^{231}Pa was continued. A study on the use of bone char as a cleansing agent for radioactive waste streams was initiated and present uncertainties on the solubility of bone char are surveyed. The separation of ^{229}Th is reported. A discrepancy in the weight of ^{234}U recovered from aged ^{238}Pu materials was unresolved. Four methods are being evaluated for the initial concentration of waste solution from recovery processing of aged ^{238}Pu heat sources. (JSR)

5937 (ORNL-tr-2974) ELECTROLYTIC RECOVERY OF METALLIC URANIUM FROM U–Nb ALLOY BY MOLTEN SALT

ELECTROLYSIS. Cho, K.; Morinaga, J.; Kuroda, T. Translated by H. Kubota from Denki Kagaku; 37: No. 11, 791-795(1969). 8p. Dep. NTIS $4.00.

The electrolytic recovery of metallic uranium by molten salt electrolysis is one method of reprocessing irradiated uranium fuel from nuclear reactors. U–Nb alloys were used for the anode with the Nb considered as the one of the fission products of the uranium fuel. The electrolysis was carried out using a UCl_3–KCl · NaCl (e.m.) bath in a purified argon atmosphere at 600 ~ 750°C. The effect of cathodic current efficiencies on the initial current density for the cathode and the UCl_3 content in the bath were observed. After electrolysis, the anode was subjected to electron-probe and visual microanalysis. The decontamination factor for Nb in the U–Nb alloy was about 70 to 700, and satisfactory elimination of other impurities was also achieved. (auth)

5938 (SGAE-2312) EXTRACTION-CHROMATOGRAPHIC SEPARATION OF RADIOSTRONTIUM AND RADIOYTTRIUM. Sorantin, H.; Jettmar, A. (Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf. Inst. fuer Strahlenschutz). Jul 1974. 13p. (In German). Dep. NTIS (US Sales Only) $4.00.

For the separation of radiostrontium and radioyttrium, teflon tubes with an internal diameter of 1 mm and a length of 4 m were impregnated with diethylhexylphosphoric acid in toluene and the Y was adsorbed from 0.1 HCl, but the Sr passed through the column. Acetone quantitatively recovered the Y. The proposed open capillary columns are recommended because of their low space requirement, simple handling, insensitivity to dry operations, and low price. (tr-auth)

5939 SORPTION OF NOBLE METAL IONS WITH LEAD, COPPER, AND MERCURY SULFIDES FROM STRONGLY ACID SOLUTIONS. Aleksandrov, S. (Univ., Sofia). Zh. Anal. Khim.; 30: No. 3, 528-532(Mar 1975). (In Russian).

Some theoretical generalizations are given based on studies of sorption of Ag(I), Au(III), Ru(IV), Rh(III), Pd(II), Ir(IV), Os(IV), Os(VIII), Pt(IV) with sulfides (PbS, CuS, HgS) from solutions of mineral acids (HCl, HNO_3, H_2SO_4, $HClO_4$). The sorption mechanism is discussed. Factors are given which cordition sorption in systems of common metal sulfide—strongly acid solution of a noble metal. A procedure is recommended of calculation of the equilibrium constant of an ion exchange process which proceeds in such a system. (auth)

5940 SOLVENT EXTRACTION OF SOME TRANSITION ELEMENTS WITH ETHERS OF DITHIOCARBAMIC ACIDS. Byr'ko, V. M.; Busev, A. I.; Kovtun, N. P. (Moscow State Univ.). Zh. Anal. Khim.; 30: No. 3, 451-458(Mar 1975). (In Russian).

Extraction of transition elements of groups I, IV, and VIII of the Periodic Table was examined with ethyl ethers of diethyl-, hexamethylene-3,5-diphenylpyrazolinedithiocarbamic acids from halide and pseudo-halide solutions. Optimal conditions for the extraction were established and the effect of inert diluents was studied. The elements were extracted in the form of ion associates. Ethyl ether of hexamethylenedithiocarbamic acid proved to be the best extractant. (auth)

5941 USE OF ORGANOPHOSPHORUS COMPLEXING AGENTS FOR CHROMATOGRAPHIC SEPARATION OF RARE EARTHS HAVING SIMILAR PROPERTIES. Kunbazarov, A.; Rudomino, M. V.; Sorochan, A. M.; Dyatlova, N. M.; Senyavin, M. M. J. Appl. Chem. USSR.; 47: No. 1, 2522-2527(Nov 1974).

Translated from Zh. Prikl. Khim.; 47: No. 11, 2452-2457(Nov 1974).

The optimal conditions (pH) and degrees of chromatographic separations of mixtures of RE with the aid of organophosphorus complexing agents (EDTP, EDDIP, HEDP), calculated by the approximate equilibrium and layer-by-layer methods, were confirmed experimentally with reference to separation of yttrium–cerium, yttrium–europium, and yttrium–terbium mixtures. It was shown that the organophosphorus complexing agents studied are highly effective for separation of pairs of RE having similar properties: yttrium–terbium and yttrium–europium, and are promising for industrial use. (auth)

5942 ION EXCHANGE EQUILIBRIA OF SOME MONOVALENT ANIONS. Fekete, E.; Inczedy, J. (Univ. of Chemical Engineering, Vesprem, Hungary). Acta Chim. Acad. Sci. Hung.; 84: No. 2, 121-124(1975).

The ion exchange equilibrium constants of chlorate, bromate, hydrocarbonate, iodate, hydroxide referred to chloride were determined on Dowex 1 × 8 resin at 18, 28 and 38°C, and the free enthalpy change, enthalpy change and entropy change values calculated using the equation of SALMON, derived by thermodynamic statistical theory. (auth)

5943 MECHANISM FOR THE EXTRACTION OF SCANDIUM AND ZIRCONIUM IONS BY β-DIKETONES AND TETRAETHYLDIAMIDEHEPTYL PHOSPHATE. Fadeeva, V. I.; Putilina, V. S.; Alimarin, I. P. (Moscow State Univ.). Izv. Akad. Nauk SSSR, Ser. Khim.; No. 3, 507-513(Mar 1975). (In Russian).

The synergistic extraction of Sc and Zr by β-diketones in the presence of a donor-active additive tetraethyldiamideheptylphosphate (TDHP) was studied. The synergistic extraction is caused by the formation of mixed complex compounds with the composition $MA_nX_{(t-n)} \cdot mTDHP$, where A is a β-diketone (benzoyl acetone, thenoyltrifluoroacetone, 1-phenyl-3-methyl-4-benzoylpyrazolone-5), X is Cl^-, ClO_4^-, or NO_3^-, and t is the valency of the metal. The adduct formation constants were calculated for the complexes studied. The extraction mechanism is discussed. (tr-auth)

5944 THIN LAYER CHROMATOGRAPHY OF SOME TRANSITION METAL DIETHYLDITHIOPHOSPHATES. Haiduc, I.; Curtui, M. Stud. Univ. Babes-Bolyai, Ser. Chem.; 19: No. 2, 71–75(1974).

The behavior of diethyldithiophosphate chelates of UO_2^{2+}, Ni^{2+}, Cu^{2+}, Ag^+, Hg^{2+}, Mn^{2+}, and Fe^{2+} on chromatographic foils with thin layers of silica gel was studied both for individual ions and for binary mixtures of UO_2^{2+} and M^{n+}. The separation of uranyl ions from other cations was possible with some solvent systems used. (tr-auth)

5945 BEHAVIOUR OF MOLYBDENUM(VI) AND MOLYBDENUM(V) ON DEXTRAN AND POLYACRYLAMIDE GELS. Ortner, H. M.; Dalmonego, H. (Metallwerk Plansee A. G., Reutte/Tyrol, Austria). J. Chromatogr.; 107: No. 2, 341-349 (Apr 1975). (In German).

The chromatographic behavior of molybdate(VI) and molybdate (V) solutions on Sephadex G-10 and of molybdate(VI) solutions on Bio-Gel P-2 was investigated. Strongly increasing chelate complex formation with the gel matrix was observed with decreasing pH values for molybdates(VI) on Sephadex G-10 and on Bio-Gel P-2, the chelation still being more pronounced on the latter. Molecular sieve effects were observed between pH 10 an 4.0 on Sephadex G-10. Two species of pentavalent molybdates separated on Sephadex G-10. The character of 0.1 M aqueous solutions of Mo(VI), W(VI), V(V) and Re(VII) is compared by aid of elution profiles at pH 10, 6 and 3 on Sephadex G-10. (NL)

5946 SEPARATION OF LANTHANIDE MIXTURES BY PRECIPITATING CHROMATES FROM HOMOGENEOUS SOLUTIONS. Borkowski, B.; Lezuchowska-Baranowska, J. (Univ., Poznan, Poland). Przem. Chem.; 54: No. 4, 242-245(Apr 1975). (In Polish).

The separation of mixture of rare earth elements was performed by way of precipitating chromates from acid solutions of nitrates of lanthanides containing potassium bichromate. Chromates were precipitated from the "homogeneous solution" by a gradual alkalization of the mixture by means of urea hydrolysis products. The sequence and pH of precipitation start were investigated for the following rare earth elements: La, Pr, Nd, Sm, Eu, Gd, Dy, Tb and Y. The compositions of chromates precipitated have been determined. Attempts at separation were made for the following systems: (1) Y + Nd, (2) Y + Gd, (3) Y + Tb, (4) Y + La + Nd. Moreover, for some systems chromate precipitation in the presence of a weak complexation agent (for instance, ammonium acetate) was carried out. The results obtained indicate that by the method of fractionated precipitation of chromates it is possible to attain a considerable enrichment of the fractions in particular components. (auth)

5947 SEPARATION OF LANTHANUM FROM A MIXTURE OF RARE EARTH ELEMENTS BY PRECIPITATION OF COMPLEX NITRILOTRIACETATES. Makovska, V.; Borkovski, B. (Univ., Poznan, Poland). Zh. Neorg. Khim.; 20: No. 4, 915-920(Apr 1975). (In Russian).

The solubility of crystallo-hydrates of the rare earth (cerium subgroup) nitrilotriacetates was studied and the possibility of using the mononitrilotriacetates for precipitating lanthanum from a natural mixture of rare earths was determined. (tr-auth)

5948 SORPTION PROPERTIES OF A FURAN ANION EXCHANGER WITH RESPECT TO MOLYBDENUM IONS. Abdilakhadov, V.; Dzhalilov, A. T.; Nazirova, R. A.; Gabrielyan, N. A. (Tashkent Polytechnic Inst.). Uzb. Khim. Zh.; No. 2, 38-40 (1973). (In Russian).

The sorption of molybdenum from solutions of ammonium molybdate (1 g/l Mo) by an anion exchanger based on the sulfide-phenol of polyethylenepolyamine and furfurol was studied at various ratios of the initial components under static conditions as a function of molybdenum ion concentration, ratio of ion concentrations in the liquid and solid phases, and pH of the medium.

Results of the adsorption are compared with anion exchanger AN-2F. It was established that the furan sulfide anion exchanger having a ratio of initial components of 2:3:3 possesses a high sorption capacity for molybdenum (220 mg/g), and can be used to extract molybdenum from commercial solutions in the pH interval from 2.5 to 6. (SJR)

5949 SORPTION OF URANIUM ON STRONGLY BASIC ANION-EXCHANGE RESINS. I. Values of Distribution Ratios in HCl and HNO_3 Media. Krtil, J.; Mencl. J.; Moravec, A. (Inst. of Nuclear Research, Rez, Czech.). Radiochem. Radioanal. Lett.; 21: No. 3-4, 115-120(10 May 1975).

The influence of the sorption medium and of the resin linkage on the sorption of microamounts of ^{233}U on anion-exchange resins were studied. For the experiments, anion exchange resins Dowex 1-X8 and Dowex 1-X2 were chosen and the distribution coefficients for ^{233}U as functions of the HCl and HNO_3 concentrations were determined. (auth)

5950 EXTRACTION OF THULIUM(III), DYSPROSIUM(III), AND SAMARIUM(III) BY DIOCTYLARSINIC ACID IN CHLOROFORM. El Seoud, M. I.; Irgolic, K. J. (Texas A and M Univ., College Station). Anal. Chim. Acta; 75: No. 2, 377-384(Apr 1975).

Dioctylarsinic acid, HDOAA, in chloroform (0.1 M) extracts thulium(III), dysprosium(III) and samarium(III) from their aqueous solutions in the pH ranges 1-6.5, 2-7 and 4-8, respectively, with extraction coefficients of approximately 0.1 for the lowest and 10 for the highest pH. The extractability increased with increasing ionic strength for each ion and decreased in the order $ClO_4^- > NO_3^- > Cl^- > SO_4^{2-}$ > acetate for solutions of the same molarity. pH-Dependence curves had slopes ranging from 1.05 to 1.87. The reagent-dependence studies gave curves with slopes between 3.60 and 5.30. The general formula $[MX_n(DOAA)_m(HDOAA)_p(H_2O)_q]$ (X = Cl^-, NO_3^-, $SO_4^{2-}/2$, ClO_4^-, acetate, OH^-; n + m = 3, m + p = 4 or 5, q ≥ 0) is suggested for the extracted species. (NL)

5951 FAST AND SIMPLE RADIOCHEMICAL SEPARATION OF ^{227}Th FROM THE ^{227}Ac SERIES. Aly, H. F. (Atomic Energy Establishment, Cairo). Radiochem. Radioanal. Lett.; 21: No. 5, 301-306(24 May 1975).

Filtrating through a filter paper loaded with TOA, it was possible to separate ^{227}Th from the ^{227}Ac series in less than 3 min. (auth)

5952 KINETICS OF CESIUM SORPTION FROM NITRATE SOLUTIONS BY TIN (IV) PHOSPHATE. Barsukova, K. V., Krylov, V. N.; Myasoedov, B. F.; Pitalev, V. G.; Rodionova, G. N. (Vernadsky Inst. of Geochemistry and Analytical Chemistry, Moscow). Radiochem. Radioanal. Lett.; 21: No. 5, 313-318(24 May 1975).

The kinetics of cesium sorption from solutions of nitric acid on inorganic ionite tin (IV) phosphate has been studied by the "thin layer" method. The work was carried out with solutions containing 0.02 gion/l cesium labelled with ^{137}Cs and 0.01 M nitric acid. It has been established that the step determining the rate of sorption in the given system is the diffusion of cesium in the sorbent grains. The diffusion coefficients and the activation energy of the sorption were calculated. (auth)

5953 KINETICS OF ZIRCONIUM(IV) SORPTION FROM NITRATE SOLUTIONS ON AN INORGANIC IONITE-TIN(IV) PHOSPHATE. Barsukova, K. V., Krylov, V. N.; Myasoedov, B. F.; Pitalev, V. G. (Vernadsky Inst. of Geochemistry and Analytical Chemistry, Moscow). Radiochem. Radioanal. Lett.; 21: No. 5, 319-325(24 May 1975).

The kinetics of zirconium(IV) sorption on tin(IV) phosphate from 2M nitric acid solutions in the temperature range 20 to 80°C was studied. The analysis of kinetic curves established that the sorption process consists of two steps, each of which is connected with the diffusion of Zr(IV) in the sorbent phase. An assumption about the possible mechanism of zirconium(IV) sorption on tin(IV) phosphate is made and the conditional diffusion coefficients and activation energy of zirconium(IV) sorption were calculated. (auth)

5954 ^{95}Zr AND ^{95}Nb SORPTION FROM URANIUM-CONTAINING NITRATE SOLUTIONS ON TIN(IV) PHOSPHATE. Barsukova, K. V.; Krylov, V. N.; Myasoedov, B. F.; Pitalev, V. G. (Vernadsky Inst. of Geochemistry and Analytical Chemistry, Moscow). Radiochem. Radioanal. Lett.; 21: No. 5, 327-333(24 May 1975).

Sorption of zirconium(IV), niobium(V) and uranium(VI) on tin(IV) phosphate at different nitric acid concentrations, under static conditions has been studied. The possibility of purifying uranium-containing solutions from $^{95}Zr(^{95}Nb)$ by filtering them through a column of tin(IV) phosphate is shown. The conditions of the desorption of these fission products with oxalic acid have been determined, which permit the use of the sorbent repeatedly. (auth)

5955 RADIOCHEMICAL SEPARATIONS OF FISSION PRODUCTS FROM LARGE EXCESSES OF ALUMINIUM. James, W. D.; Adams, D. E.; Harvey, J. T.; Sigg, R. A.; Beck, J. N.; Kuroda, P. K. (Univ. of Arkansas, Fayetteville). Radiochem. Radioanal. Lett.; 21: No. 3-4, 183-192(10 May 1975).

A radiochemical procedure is presented for the isolation of several fission products from a solution containing a large excess of aluminum. The development of this separation scheme was required in the course of "catcher foil" experiments. The catcher foils were dissolved for radiochemical analysis. The important steps in the procedure include sulfide precipitations of the fission products at varying selective acid strengths. After the gross separation of the individual fission products, each nuclide was further purified according to standard radiochemical procedures. The time of separation of any one nuclide by this chemistry was about two hours, which allows the detection of many short-lived radionuclides produced in fission. (auth)

5956 IMPULSELESS CIRCULATION GAS CHROMATOGRAPHY OF ISOTOPIC COMPOUNDS. Chizhkov, V. P.; Sinitsina, L. A. (Inst. of Organic Chemistry, Moscow). J. Chromatogr.; 104: No. 2, 327-335(Feb 1975).

Separation of isotope-containing organic compounds with $\alpha \geq 1.01$ was achieved by means of circulation gas-liquid chromatography. An equivalent length of a column close to 100 m was achieved. The optimal "impulseless" conditions for obtaining the maximum resolving power were established. (NL)

5957 TTA-CONTAINING SILICA GEL THIN-LAYER CHROMATOGRAPHY OF IRON, COBALT, ZINC, STRONTIUM, ZIRCONIUM, CESIUM, AND CERIUM. Kurotaki, K.; Kawamura, S. (National Inst. of Radiological Sciences, Chiba-shi, Japan). Radiochem. Radioanal. Lett.; 21: No. 3-4, 129-136(10 May 1975).

A TTA-containing silica gel plate was prepared, and a few metal ions were chromatographed on the plate by use of acetate buffers. The R_f values on the TTA-containing silica gel plate were compared with those on a conventional silica gel plate. It was found that the migration of the metal ions was governed by the TTA. (auth)

5958 REVERSE OSMOSIS SEPARATIONS OF SOME ORGANIC AND INORGANIC SOLUTES IN AQUEOUS SOLUTIONS USING AROMATIC POLYAMIDE MEMBRANES. Dickson, J. M.; Matsuura, T.; Blais, P.; Sourirajan, S. (National Research Council of Canada, Ottawa). J. Appl. Polym. Sci.; 19: No. 3, 801-819 (Mar 1975).

The reverse osmosis separations of some ethers, ketones, aldehydes, monocarboxylic acids, and inorganic salts in single-solute (55 to 454 ppM) aqueous solution systems using aromatic polyamide membranes were studied at 250 psig. It was found that reverse osmosis separation was essentially a function of steric parameter for ethers, and of both polar and steric parameters for ketones, aldehydes, and alcohols. Solute separations for monocarboxylic acids passed through a minimum at a pK_a value for ~4.8. The values for the free-energy parameter for Li^+, Na^+, K^+, Rb^+, Cs^+, and F^-, Cl^-, Br^-, I^-, and IO_3^- ions were calculated for the polyamide membranes used. The above values for cations are negative and those for anions are positive, suggesting that the polyamide membrane surface behaves as if it is positively charged. Further, the data show that the polyamide membrane material is only about 40% as polar as that of the cellulose acetate membrane material studied earlier. (auth)

Inorganic, Organic, and Physical Chemistry

Refer also to abstracts 6972 and 6991.

5959 INVESTIGATION OF RATES AND MECHANISMS OF REACTIONS. Part I. General Considerations and Reactions at Conventional Rates. Third Edition. Lewis, E. S. (ed.). Techniques of Chemistry, Volume VI. New York; John Wiley and Sons, Inc. (1974). 848p.

A compilation of 14 papers on the techniques and methods used in the study of rates and mechanisms of reactions is presented. The topics discussed are general methods of rate and mechanism study, activated-complex theory, homogeneous gas-phase reactions, kinetics in solution, kinetic isotope effects, tracer methods, stereochemistry and reaction mechanism, from

kinetic data to reaction mechanism, kinetics of complex reactions, homogeneous inorganic reactions, homogeneous-solution catalysis by small molecules and enzymes, mechanism in heterogeneous catalysis, use of computers, and linear-free energy relations. Separate abstracts were prepared for two of the papers. (JSR)

For abstracts of individual chapters see: 5978 and 6039.

Chemical and Physicochemical Properties

Refer also to abstracts 6070, 6474, 6941, and 8097.

5960 (AD/A-001843) THEORETICAL AND QUANTUM CHEMISTRY OF ENERGETIC SPECIES OF LIGHT METAL COMPOUNDS AND BORIDES. Final Report, 15 April 1969–30 June 1974. Kaufman, J. J. (Johns Hopkins Univ., Baltimore, Md. (USA). Dept. of Chemistry). Contract F44620-69-C-0110. 243p. (AFOSR-TR-74-1904). NTIS $7.50.

The applicability of the MS-x-alpha (multiple scattering) method to the refractory borides was investigated. Calibration calculations on the boron trihalides (fluoride through iodide) gave excellent agreement with experiment. The good agreement with experiment for pentaborane, B_5H_9, and for a carborane, 1, 6, -$B_4C_2H_8$, indicated the applicability of the method for boron polyhedra. Results for B_6H_6 (doubly negative) in a simulated crystal environment as a prototype of octahedral borides indicated that the negative charge probably would not be localized completely on the boron octahedron but would be shared with the metal atom. Ab-initio LCAO-MO-SCF calculations were carried out for a number of exotic light metal compounds. The results indicated whole new classes of light metal compounds including boron-lithium, carbon-lithium and aluminum-lithium families that should be capable of existence, synthesizable, and have the potentiality of leading to new highly energetic species. For the prototype molecules BLi_2 and CLi_2 the results for a number of different excited states showed a wealth of interesting behavior. (GRA)

5961 (CONF-750607-10) FATE OF ALIPHATIC COMPOUNDS IN NITRIC ACID PROCESSING SOLUTIONS. Clark, W. E.; Howerton, W. B. (Oak Ridge National Lab., Tenn. (USA)). 1975. 10p. Dep. NTIS $4.00.

From American Nuclear Society meeting; New Orleans, Louisiana, USA (8 Jun 1975).

The reaction of hyperazeotropic iodic acid-saturated nitric acid with short chain aliphatic iodides, nitrates, and acids was studied in order to determine the conditions for complete removal of organic materials from nitric acid systems. The aliphatic iodides are converted to the nitrates and the nitrates in strong HNO_3 are extensively converted into CO_2 and acids. The aliphatic acids are rather stable; acetic acid was unattacked by boiling in 20M HNO_3 and n-butyric acid was 80 percent unattacked. The dibasic acids oxalic and malonic are extensively attacked, but succinic acid is relatively stable. A wet oxidation method is successful in destroying acetic acid in 5 to 8M HNO_3. (JSR)

5962 (INT-65/C) INVESTIGATIONS OF THE MECHANISM OF THE SCALE GROWTH ON IRON IN ATMOSPHERE OF SULPHUR DIOXIDE. Gilewicz-Wolter, J. (Institute of Physics and Nuclear Techniques, Krakow (Poland)). 1975. 18p. (In Polish). Dep. NTIS (US Sales Only) $4.00.

Results of a study on the mechanism of the growth of scale on iron in the atmosphere containing SO_2 are presented. The partial pressure of SO_2 was 2.8×10^{-2} atm. The experiments were performed at the 800°C. In the investigations the marker as well as the radioisotopic methods have been used. SO_2 labelled by ^{35}S was used. The ^{35}S isotope was detected by the autoradiographic method. It has been shown that inward transport of S takes part in the growth of the scale. This is the S which forms the iron sulfide at the metal scale boundary. (auth)

5963 (JUL-1156) DROPLET MODEL OF PYROCARBON DEPOSITION FROM THE GAS PHASE. Linke, J.; Koizlik, K.; Luhleich, H.; Nickel, H. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Reaktorwerkstoffe und Heisse Zellen). Jan 1975. 98p. (In German). Dep. NTIS (US Sales Only) $8.00.

Based on extensive earlier work a model has been developed to describe the formation of carbon by pyrolysis of gaseous hydrocarbons. One of the central statements of this model is the assumption of the existence of a quasi liquid carbon phase during deposition process. This model is described and is discussed as are the consequences for the material properties and structural parameters which arise from it. To review the droplet model, statistically deposited pyrocarbon is examined by characterization methods suitable to analyze just these structural parameters. The results prove the model conceptions to be realistic. (auth)

5964 (MLM-2198, pp 11-14) LOW TEMPERATURE RESEARCH. 10 Apr 1975.

In Mound Laboratory activities for the Division of Physical Research: July–December 1974.

A system for transferring ortho-para D_2 mixtures into the vapor pressure cryostat was installed. Initial measurements of n-D_2 led to a correction in our platinum resistance temperature scale between 16 and 19°K. This correction explains a one percent hump in the neon vapor pressure ratio data. (auth)

5965 (MLM-2198, pp 15-31) METAL HYDRIDE RESEARCH. 10 Apr 1975.

In Mound Laboratory activities for the Division of Physical Research: July–December 1974.

A new program for fundamental research on metal–hydrogen systems was initiated. The general formalism of the band theory technique to be used in the evaluation of the metal hydrides is described. The self-consistent plane wave-Gaussian method is being compared with the Hartree–Fock method on test cases of Li and LiH. An EPR spectrometer, transportable gas rack, and devices for studying kinetics of metal–hydrogen systems are described. Measurements of the magnetic moments and spin-lattice relaxation times at room temperature were made for several titanium hydride samples of different stoichiometries. (JSR)

5966 THE ADSORPTION BEHAVIOR OF COPPER IN ELECTRODEPOSITION OF SILVER BY USING RADIOISOTOPE ^{64}Cu. Morimitsu, W. (Industrial Research Inst. of Kanagawa Prefecture, Yokohama (Japan)); Kubota, N. Kanagawa-ken Kogyo Shikenjo Kenkyu Hokoku; No, 40, 1-5(Mar 1974). (In Japanese).

The behavior of impurity copper coexisting in a silver cyanide electroplating bath was studied at the time of silver deposition, using ^{64}Cu. Identification of adsorbable or coprecipitatable copper depending on electrodeposition conditions and its distribution by autoradiography were investigated. The basic composition of the silver plating bath consisted of 30 g/l of Ag, 60 g/l of free KCN and 30 g/l of K_2CO_3. CuCN was employed as the impurity copper, and was irradiated in a thermal neutron reactor at a flux density of 5×10^{11}n/cm^2.s for 6 hours. The thus-obtained radioactive isotope ^{64}Cu, which has a half-life of 12.8 hours, was dissolved in the bath of the above-mentioned composition. The curves of current density (A/cm^2) versus voltage were examined to study the influence of physical factors such as temperature and stirring on the process of electrodeposition. Calibration curves were examined. The adsorption of copper on cathodes was found to depend on the concentration of coexisting copper, current density, and bath temperature in the stationary bath. In the stirred bath, the influence was slight. Autoradiography revealed the identification of copper adsorption on a portion having large secondary current density above 2.0 A/dm^2. The adsorption of copper occurred and saturated up to about 8,000 Å silver thickness and within one minute. (JA)

5967 LUTETIUM AND YTTRIUM PERTECHNETATES. Zaitseva, L. L.; Belikov, A. D.; Sukhikh, A. I.; Kruglov, A. A.; Chebotarev, N. T. Zh. Neorg. Khim.; 20: No. 2, 287-290(Feb 1975). (In Russian).

Lutetium and yttrium pertechnetates were synthesized and studied by x-ray phase and differential-thermal analysis. Crystallization forms with four and two molecules of water and anhydrous salts were demonstrated. Equilibrium temperatures of the corresponding phase transitions and the sequence of dehydration of the initial crystallo-hydrates were determined. (tr-auth)

5968 INVESTIGATION OF ADSORPTION COMPLEXES ON ZEOLITES BY IR SPECTROSCOPY. II. Adsorption Systems of NaA–D_2O, NaA–(D_2O, HDO), and NaA–(H_2O, HDO). Dubinin, M. M.; Isirikyan, A. A.; Mirzai, D. I. (Inst. of Physical Chemistry, Moscow). Izv. Akad. Nauk SSSR, Ser. Khim.; No. 3, 521-527 (Mar 1975). (In Russian).

The adsorption system NaA–D_2O was investigated by ir spectroscopy. The doublet structure of the absorption bands of the symmetrical and antisymmetrical valence OD oscillation of the D_2O molecule in the adsorption complex with non-localized Na^+ XX cation was detected with wave numbers at the maximum $\bar{\nu}$, 2523 and $\bar{\nu}_3$ 2583 cm^{-1}. The membership of the absorption band to 2433 cm^{-1} to the first harmonic of the deformation oscillation $2\bar{\nu}_2$ of the D_2O molecule at the wave number of the deformation oscillation XXXX $\bar{\nu}_2$ 1229 cm^{-1} was shown by isotopic exchange methods. The water molecule in the adsorption complex of the first type has a symmetrical strong field with equivalent hydrogen atoms. (tr-auth)

5969 REDUCTION OF AQUEOUS RHENATE(VII) AT A PLATINUM ELECTRODE. Mazzocchin, G. A.; Magno, F.; Bontempelli, G. (Univ., Padua). Inorg. Chim. Acta; 13: No. 3, 209-212(Jun 1975).

The electrochemical reduction of aqueous ReO_4^- at a platinum electrode has been studied by cyclic voltammetry. The reduction product has been identified as ReO_2. It has been established that the reduction of rhenate (VII) occurs via a chemical step involving adsorbed hydrogen atoms produced in the electrode reaction. The oxidation of ReO_2 in aqueous solutions was found to be a spontaneous reaction with a rate depending on pH and on its previous history. An interpretation of the reactivity of ReO_2 and ReO_4^-, with respect to TcO_2 and TcO_4^-, is also given. (auth)

Isotope Effects

5970 (AD/A-002227) ENERGY PARTITIONING AND ASSIGNMENT OF EXCITED STATES IN THE ULTRAVIOLET PHOTOLYSIS OF HI AND DI. Clear, R. D.; Riley, S. J.; Wilson, K. R. (California Univ., La Jolla, San Diego (USA). Dept. of Chemistry). Oct 1974. Contract N00014-69-A-0200-6020. 43p. NTIS $3.75.

Photofragment spectroscopy was applied to the photolysis of hydrogen iodide and deuterium iodide at 37 550/cm (266.2 nm). The extent of excited I(doublet $P(\frac{1}{2})$) atom production and the symmetry of the excited molecular states leading to dissociation are derived by measuring the translational energy and angular distributions of the recoiling H and D atoms. A nonlinear curve fitting technique is applied to the available data to separate each state's contribution to the total continuum absorption, and to provide estimates of the shape of each excited state potential energy curve. (GRA)

5971 (AED-CONF-74-183-005) MATRIX ISOLATION SPECTROSCOPY OF H_2O AND D_2O IN THE INFRARED AND FAR INFRARED REGIONS. Mann, B.; Luck, W. A. P.; Neikes, T.; Schmidt, E. (Marburg Univ. (F. R. Germany). Hygiene-Inst.). 1974. 6p. (In German). INIS.

From 73rd general meeting of the Deutsche Bunsengesellschaft fuer Physikalische Chemie e.V.; Kassel, F. R. Germany (23 May 1974).

With abstract in English and German. Published as a special print from Ber. Bunsenges. Phys. Chem., v. 78(11), 1974 p. 1236-1241.

The matrix-isolation technique permits spectroscopic studies of molecules in an inert environment at low temperatures. Spectra of H_2O in solid argon were taken in the region 4,000 to 450cm^{-1}, and of H_2O and D_2O on solid argon and nitrogen in the region 450 to 50cm^{-1}. From the spectra in the OH fundamental region a new determination of the absorption peaks dependent on water aggregates of different size, where the frequency shift of the vibrations leads to the existence of cyclic aggregates, was found. In the region 1,000 to 450cm^{-1} a broad librational band of water due to large aggregates was found. The absorption in the FIR-region at high concentrations is due to a translation of two molecules hindered by hydrogen bonding. At lower concentrations there are new adsorptions in an Ar matrix. These bands were determined to be librations of a molecule in a cyclic dimer, which could not be activated in a N_2 matrix. (auth)

5972 (COO-3498-23) PHASE EQUILIBRIUM ISOTOPE EFFECTS IN MOLECULAR SOLIDS AND LIQUIDS. Yato, Y.; Lee, M. W.; Bigeleisen, J. (Rochester Univ., N. Y. (USA). Dept. of Chemistry). 1971. Contract AT(11-1)-3498. 50p. Dep. NTIS $5.50.

The vapor pressures of three isotopic samples of N_2O enriched in ^{15}N and ^{18}O were compared with normal N_2O over the temperature range 143-219^{0}K. Over the temperature range studied in the solid and in the liquid in the neighborhood of the triple point, the vapor pressures are in the sequence $^{14}N_2{}^{16}O$ greater than $^{14}N^{15}N^{16}O$ greater than $^{15}N^{14}N^{16}O$ greater than $^{14}N_2{}^{18}O$. The crossover phenomena have been observed for $^{15}N^{14}N^{16}O/^{14}N_2{}^{18}O$ at 207^0 K and for $^{14}N^{15}N^{16}O/^{14}N_2{}^{16}O$ at 215^0. The experimental data confirm hindered translation in both the solid and the liquid as well as the potential energy coupling of the translation and rotation found in CO_2. Shifts in the internal stretching and bending modes on condensation lead to significant differences in the vapor pressures of the isomers $^{15}N^{14}N^{16}O$ and $^{14}N^{15}N^{16}O$. The latter has an abnormally large change in vapor pressure on melting compared with the other isotopic N_2O molecules studied. This is associated with the coupling of the internal bend coordinate with the translation in the solid, which vanishes in the liquid. The isotope effect in the high temperature liquid is explained in terms of an anharmonicity of the external motions in addition to the temperature dependence of the stretching force constant. Model calculations of the logarithm of the reduced partition function ratios of the solid and liquid, ln(fc/fg), are made in an anharmonic version of the Stern-Van Hook-Wolfsberg cell model. This model provides a good representation of the experimentally determined ln(fc/fg) for solid and liquid N_2O. (auth)

5973 INFRARED SPECTROSCOPIC INVESTIGATIONS OF SOLID DIIMIDE AND MATRIX-ISOLATED DIIMIDE, MONO- AND DIDEUTERO DIIMIDE. Minkwitz, R. (Freie Univ., Berlin). Z. Anorg. Allg. Chem.; 411: No. 1, 1-14(Jan 1975). (In German).

An IR-spectrum of solid diimide was measured at 5°K. In addition, the nitrogen matrix spectra of diimide, mono- and dideutero diimide were obtained and a suggestion was made as to the assignment of the frequencies measured. According to this, diimide has a trans-structure and belongs to the point group C_{2h}. (auth)

5974 KINETIC ISOTOPE STUDY OF THE REACTIONS OF AMINO ACIDS AND ALIPHATIC ACIDS WITH METHYL RADICALS IN AQUEOUS SOLUTIONS. III. Effect of pH on the Relative Reactivities of Amino Acids and Aliphatic Acids. Moger, G.; Nemesh, I.; Cherkhedii, A. (Central Scientific-Research Inst. of Chemistry, Budapest). Kinet. Catal.; 15: No. 5, 996-1000 (1974).

Translated from Kinet. Katal.; 15: No. 5, 1119-1124(1974).

The relative reactivities of α-alanine, glycine, aspartic acid, and isobutyric acid with methyl radicals were studied as a function of pH. The measurements showed that the reactivity of the α-alanine-$2d_1$ anion is 10 times greater than that of the zwitterions of the same compound. An enhanced reactivity of the anionic forms, compared with the zwitterions, is also characteristic of the radical reactions of α-alanine, glycine, and aspartic acid. The ratio of the reactivities of malonic and succinic acids was measured at pH 11.5. For the hydrogen atom abstraction reactions studied it was found that $k_{NH_3CH_2COO^-} \gg k_{COO\text{-}CH_2CH_2COO^-} > k_{COO\text{-}CH_2COO^-} > k_{NH_3^+CH_2COO^-}$. The experimental results support the conclusions of Bagdasar'yan concerning the polar effect in chain propagation reactions. It was also found that the polar effects of functional groups bound to the same carbon atom are nonadditive. This is also confirmed by the results in the literature. (auth)

5975 HOMOGENEITY AND VARIABILITY IN THE STRUCTURE OF AZURIN MOLECULES STUDIED BY FLUORESENCE DECAY AND CIRCULAR POLARIZATION. Grinvald, A.; Schlessinger, J.; Pecht, I.; Steinberg, I. Z. (Weizmann Inst. of Science, Rehovot, Israel). Biochemistry; 14: No. 9, 1921-1929(6 May 1975).

The fluorescence decay of apoazurin derived from Pseudomonas aeruginosa is monoexponential. By this criterion the population of molecules of apoazurin is homogeneous. The emission anisotropy factor and the absorption anisotropy factor at the red edge of the absorption band assume similar values, showing that the tryptophan residue in apoazurin has the same asymmetric environment both in the ground and excited states. This finding suggests tight packing of the protein at the tryptophan environment. Native azurin does not decay monoexponentially. Moreover, comparison between the quantum yield calculated from the decay kinetics and the one measured directly shows that the majority of the azurin molecules are not fluorescent. There is thus variability in the structure of azurin molecules with an equilibration time that is longer than the fluorescence lifetime. Different asymmetric environment was found for the tryptophan residue in oxidized and reduced holoprotein and in apoazurin, as studied by the circular polarization of the fluorescence. D_2O increases the fluorescence lifetime of apoazurin by 6 percent, compared to the lifetime in H_2O solution; therefore water molecules may have access to the tryptophan residue, though the latter is situated in a hydrophobic environment. (auth)

5976 DEUTERIUM ISOTOPE EFFECTS DURING FORMATION OF PHENOLS BY HEPATIC MONOXYGENASES. Evidence for an Alternative to the Arene Oxide Pathway. Tomaszewski, J. E.; Jerina, D. M.; Daly, J. W. (National Inst. of Health, Bethesda, MD). Biochemistry; 14: No. 9, 2024-2031(6 May 1975).

The in vivo and in vitro metabolisms of normal and deuterated aromatic substrates have been investigated in rats. Significant isotope effects (k/sub H//k/sub D/ equals 1.3-1.75) were associated with in vivo formation of meta-hydroxylated metabolites from 1:1 mixtures of normal and perdeuterio-(aryl ring) nitrobenzene, methyl phenyl sulfide, and methyl phenyl sulfone. Since isotope effects of this magnitude are incompatible with arene oxides as intermediates in the formation of phenols, the results provide evidence that multiple pathways are responsible for the formation of phenols in mammals. Significant isotope effects were not associated with the formation of the other phenolic isomers of nitrobenzene, methyl phenyl sulfone, or methyl phenyl sulfide or with the formation of phenolic products from anisole, bromobenzene, chlorobenzene, fluorobenzene, benzonitrile, naphthalene, zoxazolamine, acetanilide, biphenyl, diphenylhydantoin, benzene, o- and p-xylene, toluene, and

mesitylene. Significant isotope effects might not be observable with the latter substrates if the kinetic parameters for oxidation of substrate change or if the arene oxide pathway greatly predominates. Furthermore, extensive in vivo metabolism of any substrate would make isotope effects unobservable by the procedure employed, namely the analysis of isotope content in metabolites formed from 1:1 mixtures of normal and deuterated substrates. (auth)

5977 DEUTERIUM ISOTOPE EFFECT OF SINGLE VIBRONIC LEVELS IN NAPHTHALENE. Boesl, U.; Neusser, H. J.; Schlag, E. W. (Univ., Munich). Chem. Phys. Lett.; 31: No. 1, 7-11(15 Feb 1975).

The isotope effect on the vibronic spectrum of naphthalene has been investigated under conditions of high resolution, enabling the resolution of individual vibronic states. Comparing the isotope effect for fixed vibronic states leads to an unexpected smoothing which is taken as evidence for a triplet communicating system, even though the singlet state is clearly not communicating. (auth)

5978 KINETIC ISOTOPE EFFECTS. Saunders, W. H. Jr. (Univ. of Rochester, NY). pp 211-255 of Investigation of Rates and Mechanisms of Reactions. Part I. Lewis, E. S. (ed.). New York; John Wiley and Sons, Inc. (1974).

The theory of isotope effects is reviewed. The experimental determination of deuterium and tritium isotope effects is described. Types of chemical reactions in which these effects can be detected are discussed. The experimental determination of isotope effects with the heavier elements of C, S, N, and O is described. The isotope effects detectable with each of these elements are discussed. (122 references) (JSR)

5979 THE FORMALDEHYDE RADIOFREQUENCY SPECTRUM. Isotopic Substitutions. Chardon, J. C.; Genty, C.; Guichon, D.; Sungur, N.; Theobald, J. G. (Besancon Univ., 25 (France)). Rev. Phys. Appl.; 9: No. 6, 961-965(Nov 1974). (In French).

The hyperfine structure of the radiofrequency spectrum of K doubling in formaldehyde $H_2{}^{13}CO$ and D_2CO was studied, with a molecular beam spectrometer. Each line has a hyperfine structure which permits certain molecular constants to be determined. The spin-rotation constants (Mgg) and the deuteron quadrupolar coupling constant KHI(aa) are given. (FR)

5980 EFFECT OF DEUTERATION OF THE SOLVENT ON THE RATE CONSTANTS FOR FLUORESCENCE QUENCHING IN SOLUTIONS OF ORGANIC LUMINORS. Aristov, A. V.; Viktorova, E. N.; Serov, A. P. Opt. Spectrosc.; 37: No. 5, 576-577(Nov 1974).

Translated from Opt. Spektrosk.; 37: No. 5, 1004-1006(Nov 1974).

A study was conducted on the effect of deuteration on the quantum yields and quenching rate constants for the fluorescence of 4-amino-N-methylphthalimide (4-AMP) and 4-deuterio-amino-N-methylphthalimide (4-DAMP). (LK)

5981 OBSERVATION OF VIBRATIONS OF B_{2g} SYMMETRY IN THE VIBRONIC SPECTRA OF NAPHTHALENE-H_8 AND -D_8 CRYSTALS. Terenetskaya, I. P. Opt. Spectrosc.; 37: No. 5, 560-562(Nov 1974).

Translated from Opt. Spektrosk.; 37: No. 5, 983-984(Nov 1974).

An interpretation is proposed for certain bands from the absorption spectra of free single crystals of naphthalene-h_8 and naphthalene-d_8. (LK)

5982 VIBRATIONAL AND ROTATIONAL RELAXATION OF MOLECULES IN SEVERAL LIQUIDS ON THE BASIS OF RAMAN SPECTRA. Boldeskul, A. E.; Esman, S. S.; Pogorelov, V. E. Opt. Spectrosc.; 37: No. 5, 521-524(Nov 1974).

Translated from Opt. Spektrosk.; 37: No. 5, 912-918(Nov 1974).

Polarization studies have been conducted on the spontaneous Raman spectra of liquid $CHCl_3$, $CDCl_3$, $CHBr_3$, CH_2Cl_2, and CH_3NO_2 under laser excitation. Correlation functions for vibrational and orientational relaxation have been calculated for type A_1 vibrational bands. The dynamics of molecular reorientation in these liquids is discussed. (auth)

5983 REACTIONS OF HYDROGEN AND DEUTERIUM WITH SILANE AND MONO-, DI-, AND TRIMETHYLSILANES AT ROOM TEMPERATURE. Cowfer, J. A.; Lynch, K. P.; Michael, J. V. (Carnegie-Mellon Univ., Pittsburgh). J. Phys. Chem.; 79: No. 12, 1139-1147(5 Jun 1975).

The reactions of H and D with silane and monomethyl-, dimethyl-, and trimethylsilanes have been studied at room temperature and 3 Torr of He in a discharge-flow apparatus. The method of detection is time-of-flight mass spectrometry. Rate constants based on atom depletion in reactant-rich systems or reactant depletion in atom-rich systems have been measured, and stoichiometry factors have been estimated. Also products of the reactions have been identified, and reaction profile experiments have been carried out. Mechanisms are proposed for these eight reactions which are consistent with observations and invoke considerable atomic cracking through chemical activation. The theoretical basis for this result is qualitatively discussed, and the observed isotope effects are also compared to theoretical BEBO estimates. (auth)

Isotope Exchange and Isotope Separation

Refer also to abstract 6602.

5984 (MLM-2198) MOUND LABORATORY ACTIVITIES FOR THE DIVISION OF PHYSICAL RESEARCH: JULY–DECEMBER 1974. (Mound Lab., Miamisburg, Ohio (USA)). 10 Apr 1975. Contract AT-33-1-GEN-53. 69p. Dep. NTIS $5.45.

Progress made in the areas of isotope separation, low temperature research, metal hydride research, separation chemistry, and separation research is presented. Separate abstracts were prepared for each of the 5 areas of study. (JSR)

For abstracts of individual sections see: 5936, 5964, 5965, 5985, and 5986.

5985 (MLM-2198, pp 8-10) ISOTOPE SEPARATION. 10 Apr 1975.

In Mound Laboratory activities for the Division of Physical Research: July–December 1974.

^{37}Ar enrichments with enrichment factors greater than 70 were performed. ^{13}C-labeled CO_2, CH_4, and $BaCO_3$ and elemental ^{13}C were produced. The modifications to thermal diffusion cascades and the operation of purification chromatograph and Ti furnace trap system for the production of $^{78\ 82\ 83\ 86}Kr$ were described. The modifications to thermal diffusion systems and the operation of the purification chromatograph for the production of ^{134}Xe were reported. (JSR)

5986 (MLM-2198, pp 46-64) SEPARATION RESEARCH. 10 Apr 1975.

In Mound Laboratory activities for the Division of Physical Research: July–December 1974.

The prototype chemical exchange system for enriching rare Ca isotopes was operated with total reflux. CS_2 enriched to 50 percent ^{34}S is being separated in a thermal diffusion cascade for the separation of ^{34}S. The first part of a new series of total scattering cross section measurement for Ar–He was completed and the data tabulated. New determinations of the thermal diffusion factor for ^{20}Ne–^{22}Ne were in agreement with earlier results. Corrected thermal diffusion factors for Ne, Ar, Kr, and Xe are tabulated. Thermal diffusion data for Ne, Ar, Kr, and Xe are compared to the extended corresponding states theory and a method given to improve the accuracy of the calculation. The temperature dependence of the thermal diffusion factor of an equimolar mixture He–Kr and He–Xe is given for the temperature range 250 to 725°K. (JSR)

5987 CHIRAL 1,4-BENZODIAZEPINES. VIII. Concerning the Rate of H/D Exchange and Optical Stability of the Chiral Center C(3). Stromar, M.; Sunjic, V.; Kovac, T.; Klasinc, L.; Kajfez, F. (Univ., Zagreb). Croat. Chem. Acta; 46: No. 4, 265-274(1974).

Various chiral substituted 1,4-benzodiazepin-2-ones with 3-acyloxy (general formula I), 3-hydroxy- and 3-alkoxy (general formula II), 3-alkyl (general formula III) and 3-quaternary ammonium (general formula IV) groups as substituents were subjected to C(3)-H-D exchange rate measurements in order to obtain information on the optical stability of the chiral center and on the mechanism of racemization. Only type IV compounds (IVa–j) exhibited H/D exchange, but acid catalyzed racemization took place in type I and II compounds, indicating some other mechanisms in this process. Type III compounds as free bases (IIIa–c), N^4-protonated acids, or N^4-oxides (III, e; f) underwent no H/D exchange and are optically stable as well. In cases where deprotonation-reprotonation mechanism of racemization can be excluded two other mechanisms are discussed, i.e., acid-catalyzed ring-chain tautomerism and identity substitution with alkoxide ion. (auth)

5988 REACTIVITY OF OXYGEN ON THE SURFACE OF COMPLEX OXIDES. IV. Isotope Exchange of Oxygen and Selectivity in the Oxidation of Methanol on Vanadium–Chromium Oxide Catalysts. Koval, L. M.; Muzykantov, V. S.; Kurina, L. N.; Boreskov, G. K. (Inst. of Catalysis, Novosibirsk, USSR). Kinet. Catal.; 15: No. 5, 1060-1063(1974).

Translated from Kinet. Katal.; 15: No. 5, 1193-1197(1974).

Ten samples of vanadium–chromium oxide catalysts of varying compositions were investigated in relation to the isotope exchange of oxygen and the oxidation of methanol. The reactivity of the oxygen depends in a significant way on the composition of the catalysts. The activity of the catalysts in relation to the extensive oxidation of methanol is increased with a decrease in the strength of the bond between the oxygen and the surface; the variation in selectivity with respect to formaldehyde is opposite in character. (auth)

5989 INFRARED SPECTROSCOPIC AND MASS-SPECTROMETRIC STUDY OF THE ADSORPTION AND HYDROGEN–DEUTERIUM EXCHANGE OF 2,3-DIHYDROBENZOFURAN ON ALUMINOSILICATES. Karakhanov, E. A.; Lysenko, S. V.; Berentsveig, V. V.; Sharbatyan, P. A.; Viktorova, E. A.; Rudenko, A. P. (Moscow State Univ.). Russ. J. Phys. Chem.; 48: No. 8, 1224-1226 (Aug 1974).

Translated from Zh. Fiz. Khim.; 48: No. 8, 2072-2075(Aug 1974).

The infrared spectra of 2,3-dihydrobenzofuran (I) and indan adsorbed on deuterated and non-deuterated aluminosilicates have been obtained. The products of their H–D exchange with the aluminosilicate OD groups have been analysed mass-spectrometrically. Differences between the products of the H–D exchange of compound I and indan (not only mono- and di-substituted but also tri-substituted derivatives are obtained for indan) showed that compound I undergoes oriented adsorption on the adsorbent surface via the oxygen atom of the five-membered ring. (auth)

5990 STATIC AND DYNAMIC ISOTOPE EXCHANGE SEPARATIONS ON HYDROPHOBIC ORGANIC PHASES IMMOBILIZED IN PLASTICIZED OPEN-CELL POLYURETHANE FOAMS. Braun, T.; Farag, A. B. (Eotvos Univ., Budapest). J. Radioanal. Chem.; 25: No. 1, 5-16(1975).

The preparation of TBP-plasticized polyurethane foam containing iodine or silver dithizonate was described. Rapid isotope exchange separations of radioiodide and radiosilver on the plasticized iodine and silver dithizonate foams, respectively, were achieved by batch and column techniques. The effect of various factors on the exchange yield of radioiodide and radiosilver on the proposed reagent foams were critically investigated. The mobility of iodide ion in the iodine foam proved to be high enough so that all the iodine coated membranes of the foam material participate in the isotope exchange reaction and the equilibrium attained rapidly. (auth)

Feed Materials Processing

Refer also to abstract 6791.

Radiation Chemistry

Refer also to abstracts 6043, 6056, 6590, 6615, 6626, 7209–7212, and 8419.

5991 (AD-787531) RADIATION EFFECTS IN CROSSLINKING IN POLYMERIC SYSTEMS. Report No. 10, 1 October 1968–31 July 1974 (Final). Odian, G. (Richmond Coll., Staten Island, N. Y. (USA)). 24 Sep 1974. 8p. (AROD-7923.1-C). NTIS $3.25.

Research findings on a project involving the elucidation of the process of radiation-induced graft polymerization of monomer to polymer are outlined. The quantitative interrelationships of the initiation rate, the $K(P)/K^{+}$ ratio for the monomer, the equilibrium solubility of the monomer in the polymer, the polymer film thickness, the reaction time, and the diffusivity of the monomer in the polymer were investigated. Work on the project has given a mathematic analysis of the grafting reaction and its exact dependence on these factors. Equations show quantitatively how the various parameters in any grafting system interact to lead to diffusion-controlled graft polymerization. (GRA)

5992 (BMFT-FBK-75-02) RADIATION CHEMICAL ADDITION OF FORMAMIDE TO α-OLEFINS. Dederichs, B.; Saus, A.; Siebertz, H. (Technische Hochschule Aachen (F. R. Germany). Inst. fuer Technische Chemie und Petrolchemie). Mar 1975. 23p. (In German). Dep. NTIS (US Sales Only) $4.25. Germany DM 4.20.

The radiation-initiated addition of formic acid amide to n-octene-(1), n-decene-(1) and n-dodecene-(1) was investigated in a homogeneous (tert.-butanol as a solvent) and heterogeneous phase (without solvents) as a function of molar ratio of the reactants, temperature, reaction time and chain length of the olefins. With the optimal molar ratio of 37:1 (formic acid amide:olefin) and at 20°C the maximum yields are 9% of alkane carbonic acid amides in the homogeneous phase and, under simultanous stirring, 27% in the heterogeneous phase. Increasing the temperature to 80°C gives higher yields in alkane carbonic acid amides up to 34% (homogeneous phase) and 52% (in heterogeneous phase), respectively. Best results are obtained with n-decene-(1). In every case an induction period is observed. (auth)

5993 (BMFT-FBK-75-03) RADIATION-INITIATED TELOMERISATION OF FORMIC ACID AMIDE AND ETHYLENE. Dederichs, B.; Saus, A.; Rath, H. P. (Technische Hochschule Aachen (F. R. Germany). Inst. fuer Technische Chemie und Petrolchemie). Mar 1975. 46p. (In German). Dep. NTIS (US Sales Only) $5.50. Germany DM 8.40.

The radiation-initiated telomerization of formic acid amide and ethylene is possible by the use of pressure. The yield of primary alkane carbonic acid amides is proportional to the absorbed dose. G values are: $G(\text{amide}) \approx 90$, $G(-C_2H_4) \approx 260$, with maximum yields at 60°C. The distribution of telomers corresponds to a geometrical progression. It is unaffected by the radiation dose. Within the range of 30 to 100 atm the reaction-pressure is of no influence upon the product yields, but there is a linear connection between the consumption of ethylene and the molar ratio of ethylene solved in the reaction mixture. The small propagation constants (0.01 to 0.02) show that the relatively high amount of short-chain carbonic acid amides is due to the solubility of ethylene in formic acid amide (2 mol-% at 50 atm, 2.3 mol-% at 100 atm). Solvents generally lower the G values, but the distribution of chain length is shifted to higher carbonic acid amides. With increasing dielectrical constants of the solvents used the G values drop to small amounts. Solvents with active hydrogen lead to uncontrolled side reactions. (auth)

5994 (BNL-19843) THERMAL DECOMPOSITION OF AMMONIUM PERCHLORATE DURING GAMMA-RAY IRRADIATION. Fuller, G. E.; Levy, P. W. (Brookhaven National Lab., Upton, N.Y. (USA)). 1975. 8p. (CONF-750703-5). Dep. NTIS $4.00.

From IEEE annual conference on nuclear and space radiation effects; Arcata, California, USA (14 Jul 1975).

To assess radiation damage effects in propellants, pyrotechnics, and similar materials, thermal decomposition measurements were made on ammonium perchlorate powders and crystals during gamma-ray irradiation. Gas evolution studies were made on single crystals and powders of ammonium perchlorate, both at room temperature and at 227°C. The results are discussed. (LK)

5995 (COO–3035-2) RADIATION CROSSLINKING OF POLYMERS WITH SEGREGATED METALLIC PARTICLES. Final Report, June 1, 1971–September 30, 1973. Corneliussen, R. D.; Kamel, I.; Kusy, R. P. (Drexel Univ., Philadelphia, Pa. (USA)). 1973. Contract AT(11-1)-3035. 127p. Dep. NTIS $9.50.

Through the past four years of research, a new approach to fabricating conductive polymer/metal composites has been developed. This approach consists of compacting mixtures of polymer and metal powders and then stabilizing the composite through radiation-induced crosslinking. The result is a mechanically strong, conductive materials consisting of two intertwining networks. One is a massive network consisting of fused crosslinked, large (greater than 100 mu) polymer particles while the other is a fine network of small, metallic particles (greater than 10 mu). Nine different systems including crystalline, amorphous, and rubbery polymers were studied. Processing at this time is limited to compression molding in a closed die because of network stability problems. Costs for processing were estimated at about $6,000/lb compared to $50.00 and up for commercial material based on random networks. (auth)

5996 (COO–3569-4) GAS PHASE RADIOLYSIS AND VACUUM ULTRAVIOLET PHOTOLYSIS OF HETEROCYCLIC ORGANIC COMPOUNDS. Progress Report, February 1, 1974–February 1, 1975. Scala, A. A.; Salomon, D.; Colon, L.; D'Angona, J. (Worcester Polytechnic Inst., Mass. (USA)). 1975. Contract AT(11-1)-3569. 26p. Dep. NTIS $4.50.

In the gamma radiolysis of tetrahydrofuran there are pronounced density effects in the pressure range from 0 to 50 Torr with the most important ion-pair yields decreasing as the pressure increases. The relative product yields of the radiolysis is compared with that of xenon photolysis. Possible mechanisms to explain the results obtained are discussed. The ion-pair yields from the gamma radiolysis of the heterocyclic amines, ethylenimine, azetidine, pyrrolidine, and piperidine, are determined, and the pressure effects are evaluated. Reactions mechanisms are discussed. The vacuum ultraviolet photolysis products of thietane and tetrahydrothiophene are studied and compared with gamma radiolysis products. Reaction mechanisms are discussed. The status of the construction of a photoionization

mass spectrometer and the measurement of the ionization efficiencies and extinction coefficients of organic compounds is reported. (JSR)

5997 (SGAE-2272) RADIATION CROSSLINKING OF STABILIZED POLYETHYLENES FOR THE PREPARATION OF EXTREMELY CHANGE-RESISTANT PROFILES, FIRST PHASE. Schaudy, R.; Hubeny, H.; Schmitz, E.; Proksch.; Schrott, S. (Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf. Inst. fuer Chemie). Apr 1974. 51p. (In German). Dep. NTIS (US Sales Only) $5.75.

High-pressure polyethylene was impregnated with various stabilizers and made into sheets. The sheets were exposed to 10 or 20 Mrad in the electron accelerator and then subjected to artificial weathering. Some of the sheets were exposed to intensive uv weathering. The results showed that the preparation conditions have a great effect on the properties of the unirradiated and non-cross-linked samples. The degree of cross-linking at equal doses is strongly dependent on the type and concentration of stabilizers and only slightly dependent on the preparation conditions. Primary and secondary antioxidants inhibit relatively strongly the cross-linking. The same is true for multifunctional compounds, but the uv-stabilizers, especially soot, exert no inhibiting effects. The tensile strength is independent of the cross-linking and the weathering or a combination of the two. The uv-intensive weathering shows the excellant effectiveness of soot. The colorless stabilizers have low effectiveness. Fracture stress depends on the stabilizer. Cross linking increased the fracture stress. Weathering resistance increases qualitatively with cross-linking. A decrease of the stabilizer effect by ionizing radiation could not be established. Shock resistance was increased by cross-linking. Thermal studies showed qualitatively the increased thermal stability of the cross-linked samples. (tr-auth)

5998 (SGAE-2305) RADIATION-CHEMICAL CROSS-LINKING OF POLYETHYLENES. Schaudy, R. (Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf. Inst. fuer Chemie). Jul 1974. 23p. (In German). Dep. NTIS (US Sales Only) $4.25.

A review is given of the chemistry of the radiation-induced cross-linking of polyethylenes and the factors affecting it. The property changes obtained from crosslinking (solubility, thermal stability, mechanical properties, and electrical properties) and the most important technological problems are discussed. (101 references) (JSR)

5999 (TID-26777) INTERACTION OF RADIATION WITH MATTER. Progress Report, August 1, 1974–July 31, 1975. (New York Univ., N. Y. (USA). Dept. of Physics). Mar 1975. 100p. Dep. NTIS $8.00.

Studies on the energy and charge transfer processes that occur in organic solids as a result of the absorption of radiation in the energy range from approximately 1 eV to 25 MeV are reported. A dominant feature is the use of an external magnetic field to examine the properties of triplet excitons in ordered solids. Studies on triplet probes, luminescence, and charge carriers are reported. Future research planned in these areas is extensively described. A list of publications resulting from the research is appended. (JSR)

6000 GRAFT POLYMERIZATION OF VINYL PYRIDINE MONOMERS IN A SOLVENT SYSTEM CONTAINING A NITROGEN-CONTAINING COMPOUND BY THE USE OF RADIATION. Garnett, J. L.; Martin, E. C. British Patent 1,374,893/B/. 20 Nov 1974. 11p.

A process is described for the γ-radiation pack polymerization of vinyl pyridine monomers on to a polymer backbone in a solution containing at least 5% by weight of a compound of formula $NHR(CH_2)_n OH$, where R is a CH_3 group or a H-atom and n = 2 to 6. The polymer backbone may be a cellulosic material, wool, polyethylene, polystyrene, etc. Irradiation is at a dose rate of 0.005 to 1 MR per hour, and the total dose is 0.1 to 10 MR. Methyl or ethyl alcohol may be present in the solvent. (UK)

6001 CURING OF WOODEN AND INORGANIC MATERIALS WITH POLYMERS AND IONIZING RADIATION. Pesek, M. (Vyrobu a Vyuziti Radioisotopu, Prague). Radioisotopy.; 16: No. 2, 195-204(Apr 1975). (In Czech).

A brief survey of the use of ionizing radiation and polymers for stabilization and preservation of old and historical objects and antiquities is presented. The employed techniques and composition of monomers suitable for the pre-irradiation impregnation of porous materials and application possibilities are discussed. (auth)

6002 FORMATION OF GLUCOSE DURING THE IRRADIATION OF AQUEOUS SOLUTIONS OF β-BENZYL-D-GLUCOSIDE. Kudryashov, L. I.; Nedoborova, L. I.; Chizhov, O. S.; Kochetkov, N. K. (Inst. of Organic Chemistry, Moscow). Izv. Akad. Nauk SSSR, Ser. Khim.; No. 3, 722-724(Mar 1975). (In Russian).

In the study of the radiolysis mechanism of β-benzyl-d-glucoside by the isotopic exchange method using ^{18}O it was shown that the radio-induced break of the glycoside bond does not include the stage of the intermediate formation of the carbonium ion of glycose. (tr-auth)

6003 PULSE RADIOLYTIC FORMATION OF SOLVATED ELECTRONS, ION-PAIRS, AND ALKALI METAL ANIONS IN TETRAHYDROFURAN. Salmon, G. A.; Seddon, W. A.; Fletcher, J. W. (Atomic Energy of Canada, Chalk River, Ont.). Can. J. Chem.; 52: No. 18, 3259-3268(15 Sep 1974).

Pulse radiolysis of solutions of alkali metal cations in tetrahydrofuran (THF) demonstrates the formation of solvated electrons, alkali metal cation-ion pairs and alkali metal anions. The spectra, extinction coefficients, and radiolytic yields of solvated electrons, lithium, sodium, potassium, and cesium species in THF are described. (auth)

6004 BEHAVIOR OF HYDRATED ELECTRONS IN MICELLAR SOLUTION. Studies with Cetyltrimethylammonium Bromide-Cetylpyridinium Chloride Mixed Micelles. Patterson, L. K. (Carnegie-Mellon Univ., Pittsburgh); Graetzel, M. J. Phys. Chem.; 79: No. 10, 956-960(8 May 1975).

Rates of electron disappearance have been measured in solutions of cetyltrimethylammonium bromide micelles (CTAB) labeled with varying quantities of highly reactive cetylpyridinium chloride (CPyCl). Investigations of systems containing more than one probe per micelle (P/M greater than 1) allow discrimination between interaction of e^-/sub aq/ with the micelle and with the reactive probe; in systems where (P/M less than 1) the migration of electrons from micelle to micelle may be examined. The results of these studies are consistent with a model in which three separate processes influence electron behavior: (1) trapping of e^-/sub aq/ by the CTAB micelle surface (k/sub T/ approximately 6×10^{11} M^{-1} sec^{-1}); (2) movement on the surface to a single reactive probe molecule (tau less than 3 nsec); (3) migration of the electron from micelle to micelle (dependent on surfactant concentration). These processes are interpreted in terms of e^-/sub aq/ interaction with the micellar surface potential field. (auth)

6005 PULSE RADIOLYSIS OF MERCURIC OXIDE IN NEUTRAL AQUEOUS SOLUTIONS. Fujita, S. I.; Horii, H.; Mori, T.; Taniguchi, S. (Radiation Center of Osaka Prefecture). J. Phys. Chem.; 79: No. 10, 960-964(8 May 1975).

The reduction of HgO in deaerated aqueous solutions was studied by the pulse radiolysis technique and spectrophotometric analysis after electron pulse irradiation. HgO reacts with e^-/sub aq/ with a rate constant of $(2.3 \pm 0.2) \times 10^{10}$ M^{-1} sec^{-1} to yield a transient species of HgOH having an absorption maximum at 233 nm and a shoulder at 260-270 nm ($epsilon^{240}$ $(5.3 \pm 0.2) \times 10^3$ M^{-1} cm^{-1}). The pK of the equilibrium, Hg^+ reversible HgOH, was estimated as 5.1. HgOH dimerizes with a rate constant of 2k equals $(4.4 + -0.5) \times 10^9$ M^{-1} sec^{-1} at the lower concentration of HgO (less than approximately 100 muM). The dimer, assigned to Hg_2O or $Hg_2(OH)_2$, has an absorption maximum at 215 nm with a shoulder at 230 nm and further decays according to a first-order rate law. At higher concentrations of HgO, however, the formation of polynuclear mercury oxide having a longer lifetime was taken into consideration from some evidence. (auth)

6006 DECAY CHARACTERISTICS OF SOIL THERMOLUMINESCENCE. Nishita, H.; Moore, R. H.; Beckman, R. J.; Hamilton, M. (Los Alamos Scientific Lab., NM). Soil Sci.; 119: No. 4, 259-268(Apr 1975).

Thermoluminescent decay of five different types of soils (soil no. 4FF, Yolo sandy loam, Hanford sandy loam, soil no. 9RDG, and Egbert muck) irradiated by ^{60}Co photons and in the reactor was examined. Although the glow output and the glow curve shapes differed considerably among the soils, the shape of the thermoluminescent decay curves, in general, was quite similar, whether the soil was irradiated by ^{60}Co photons or in the reactor. Regardless of the soil type, the most rapid decay occurred within the first 24 hr after irradiation. After the lapse of sufficient decay time, an apparent isothermal equilibrium state was approached. Curves were fitted to the decay data by the use of a computer program which obtains a weighted least squares fit of a function to the data by means of stepwise Gauss-Newton iterations on the parameters. The results indicated that the thermoluminescent decay curves of soils were hyperbolic [Y equals alpha (beta + X) /sup gamma/ + delta] in form. (auth)

6007 RATE CONSTANTS FOR THE REACTION OF THE OH RADICAL WITH H_2 AND NO (M equals Ar AND N_2). Atkinson, R.; Hansen, D. A.; Pitts, J. N. Jr. (Univ. of California, Riverside). J. Chem. Phys.; 62: No. 8, 3284-3288(15 Apr 1975).

Absolute rate constants for the reaction of OH radicals with H_2 and NO (M equals Ar, N_2) have been determined at 298 +-1°K using a flash photolysis-resonance fluorescence technique. The rate constant for the reaction OH + H_2 was determined to be (6.97 +- 0.70) x 10^{-15} cm^3 $molecule^{-1}$ sec^{-1} in good agreement with recent literature values. Rate constants for the reaction OH + NO + M (M equals Ar) were obtained over the pressure region 25-655 torr, while a rate constant for M equals N_2 was obtained at 25 torr total pressure. The low pressure third order rate constants for this reaction were determined to be (4.25 +- 0.43) x 10^{-31} cm^6 $molecule^{-2}$ sec^{-1} (M equals Ar) and (6.1 +- 0.7) x 10^{-31} cm^6 $molecule^{-2}$ sec^{-1} (M equals N_2), in good agreement with the available literature values. The bimolecular rate constants at 760 torr total pressure were determined to be (5.2 +- 0.8) x 10^{-12} cm^3 $molecule^{-1}$ sec^{-1} for M equals Ar and (6.1 +- 1.0) x 10^{-12} cm^3 $molecule^{-1}$ sec^{-1} for M equals N_2. A value of 8 x 10^{-12} cm^3 $molecule^{-1}$ sec^{-1} was obtained as a probable lower limit for the limiting high pressure second order rate constant from an extrapolation of the data. (auth)

6008 ABSORPTION SPECTRA AND KINETICS OF METHYL AND ETHYL RADICALS IN WATER. Hickel, B. (CEN de Saclay, Gif-sur-Yvette, France). J. Phys. Chem.; 79: No. 11, 1054-1059 (22 May 1975).

The absorption spectra and some kinetic properties of the methyl and ethyl radicals in water were studied by pulse radiolysis. For methyl radicals the maximum of the absorption spectrum lies at 213 nm (epsilon 1600 M^{-1} cm^{-1}) while the ethyl radical spectrum shows no maximum down to 200 nm. The disappearance of methyl and ethyl radicals follows second-order kinetics. At 25°, k/sub (CH_3 + CH_3)/ equals 1.6 +- 0.2 x 10^9 M^{-1} sec^{-1} and k/sub (C_2H_5 + C_2H_5)/ equals 1.2 +- 0.2 x 10^9 M^{-1} sec^{-1}. The effect of temperature on the rate of recombination gives an apparent activation energy of 3.9 +- 0.4 kcal/mol for both methyl and ethyl radicals, and is close to the activation energy for the diffusion of the radicals in water. In the presence of oxygen a new spectrum appears centered at 250 nm with a lifetime in the millisecond range. A study of the effect of pH on this spectrum shows that the new species is not HO_2 formed by H atom transfer to the oxygen but RO_2 formed by direct addition of the radical to oxygen. For ethyl radicals the rate constant of this addition is k/sub (C_2H_5 + O_2)/ equals 2.9 +- 0.8 x 10^9 M^{-1} sec^{-1}. The reaction of the two alkyl radicals with H_2O_2 was investigated by pulse and steady-state radiolysis. The rate constant between CH_3 and C_2H_5 and H_2O_2 is comparatively slow k less than or equal to 10^6 M^{-1} sec^{-1} and there is no indication that the reaction proceeds via a chain mechanism. (auth)

6009 RADICAL INTERMEDIATES PRODUCED FROM THE ONE-ELECTRON REDUCTION OF LUMAZINE IN WATER. Hayon, E.; Moorthy, P. N. (Army Natick Labs., MA). J. Phys. Chem.; 79: No. 11, 1059-1062 (22 May 1975).

The one-electron reduction of lumazine (LH_2) in aqueous solutions was brought about using e^-/sub aq/ and $(CH_3)_2COH$ radicals as the reducing agents. The fast-reaction technique of pulse radiolysis and kinetic absorption spectrophotometry was used to monitor and determine the spectral characteristics and acid-base properties of the free-radical intermediates produced. The reaction rate constants of e^-/sub aq/ and $(CH_3)_2COH$ radicals with the neutral and ionic forms LH_2, LH^-, and L^{2-} of lumazine were determined. The reactivity toward e^-/sub aq/ is 2-3 x 10^{10} M^{-1} sec^{-1}. At pH 5.2, the reaction of e^-/sub aq/ or $(CH_3)_2COH$ with LH_2 gives rise to an initial transient (T_1) which changes with time to another transient species (T_2). It is shown that proton donors lead to the change T_1 yields T_2. The rate constants for the reaction of T_1 with H_3O^+, LH_2, and $H_2PO_4^-$ are 1.6 x 10^{10}, 2.7 x 10^8, and 3.6 x 10^8 M^{-1} sec^{-1}, respectively. The $-N_3H$ in lumazine is suggested to act as the proton donor for this reaction. Based on the transient spectra and ionization constants of the free radicals formed at pH 0.8, 5.2, 10.2, and 14.0, a tentative scheme of reactions is suggested for the formation of the $LH_4^{\cdot+}$, $(LH_2)^{\cdot-}$, $LH_3^{\cdot}$, $LH_2^{\cdot-}$, and $LH^{\cdot 2-}$ radicals. (auth)

6010 OXIDATION OF AROMATIC AMINES AND DIAMINES BY OH RADICALS. Formation and Ionization Constants of Amine Cation Radicals in Water. Hayon, E.; Rao, P. S. (Army Natick Labs., MA). J. Phys. Chem.; 79: No. 11, 1063-1066 (22 May 1975).

The one-electron oxidation by hydroxyl radicals of aromatic amines and diamines in water was studied using the fast-reaction technique of pulse radiolysis and kinetic absorption spectrophotometry. The following compounds were examined: N,N,N',N'-tetramethyl-p-phenylenediamine (TMPD), p-phenylenediamine (PD), N,N-dimethyl-p-phenylenediamine (DMPD), N,N,N',N'-tetramethylbenzidine (TMB), and diphenylamine (DPA). The main initial reaction of the OH radicals is suggested to be an addition to these compounds to give absorption spectra which absorb strongly in the visible and uv regions. These OH radical adducts decay by first-order kinetics and have lifetimes of approximately 5-50 mu sec, dependent on the pH, buffer concentration, and the nature of the aromatic amines and diamines. They decay to give species with somewhat similar absorption spectra and extinction coefficients, which are very long lived in the absence of oxygen. The latter species are assigned to the cation radicals $TMPD^{\cdot+}$, $PD^{\cdot+}$, $DMPD^{\cdot+}$, $TMB^{\cdot+}$, and $DPA^{\cdot+}$. The OH radical adducts and the cation radicals have acid-base properties. The pK/sub a/ values of the cation radicals $TMPDH^{\cdot 2+}$, $PDH^{\cdot 2+}$, $DMPDH^{\cdot 2+}$, $TMBH^{\cdot 2+}$, and $DPAH^{\cdot 2+}$ were found to be 5.3, 5.9, 6.1, 5.1, and 4.2, respectively. The results indicate that these aromatic amines and diamines can be oxidized by free radicals to yield the corresponding cation radicals. (auth)

6011 RADIATION-INDUCED HOMOLYTIC AROMATIC SUBSTITUTION. III. Hydroxylation and Nitration of Benzene. Eberhardt, M. K. (Puerto Rico Nuclear Center, San Juan). J. Phys. Chem.; 79: No. 11, 1067-1069 (22 May 1975).

The radiolysis of aqueous $NaNO_3$ solutions (1 M) saturated with benzene has been studied under a variety of conditions. The main products are phenol, nitrobenzene, and biphenyl, whose yields are dependent on dose, dose rate, oxygen concentration, and pH. In the presence of oxygen the yield of phenol increases whereas nitrobenzene and biphenyl formation is almost completely suppressed. Low pH increases the yield of phenol and nitrobenzene and decreases the yield of biphenyl compared to neutral solutions. Contrary to previous reports only trace amounts of o- and p-nitrophenol were found in a ratio of 60 percent ortho:40 percent para. A mechanism for the formation of the products involving ·OH, $NO_2^{\cdot}$, and $NO_3^{\cdot}$ radicals has been proposed. (auth)

6012 REACTIONS OF TRAPPED ELECTRONS BY QUANTUM MECHANICAL TUNNELING OBSERVED BY PULSE RADIOLYSIS OF AN AQUEOUS GLASS. Miller, J. R. (Argonne National Lab., IL). J. Phys. Chem.; 79: No. 11, 1070-1078 (22 May 1975).

Reactions of trapped electrons with electron acceptors appear to involve electron transfer by quantum mechanical tunneling through tens of angstroems of inert solvent. These reactions are observed by pulse radiolysis of aqueous 6 M NaOH solutions frozen to a rigid glass. The observed reactions show several unusual kinetic features, including the following. (1) The reactions progress with the logarithm of time over our experimental time range, less than 10^{-6} to 10^3 sec. (2) The reaction rates are independent of temperature from 77 to 143°K. (3) A tenfold change in acceptor concentration decreases the lifetime of the trapped electrons by about 10^6. (4) Rates of reaction with different acceptors vary over a range greater than 10^{10} for acceptors whose rate constants for reaction with hydrated electrons in liquid water differ by less than 10^2. These observations are in good agreement with model calculations of electron tunneling. The evidence for tunneling, inferences about some mechanistic details of electron tunneling reactions, and possible alternative mechanisms to tunneling are discussed. It is concluded that Franck–Condon restrictions, which depend strongly on the difference between the electron affinity of the acceptor and the energy of the donor, may be an important cause of the very low reactivities of weak acceptors. However it may also be necessary to invoke some more complex electronic process to explain the apparently stronger dependence of reaction rate on distance for weak acceptors. (auth)

6013 HYDROXYL RADICAL INDUCED OXIDATION OF NITROBENZENE. Bhatia, K. (Carnegie-Mellon Univ., Pittsburgh). J. Phys. Chem.; 79: No. 10, 1032-1038 (8 May 1975).

The hydroxylation of nitrobenzene by radiolytic techniques was examined by high-performance liquid chromatographic techniques. Owing to improvements in the method of analysis it was possible to measure phenol in air-saturated nitrobenzene solutions irradiated to low doses. The initial yields for the consumption of nitrobenzene and the formation of phenol and isomeric nitrophenols in N_2O- and air-saturated systems were measured in order to establish the primary reactions of hydroxyl radicals with nitrobenzene. The initial yields for the consumption of nitrobenzene were 3.7 and 2.6 and that for total phenol were 2.3 and 2.4 in N_2O- and air-saturated systems, respectively, in samples irradiated at low dose rates (0.8 krad g^{-1} min^{-1}). Nearly 80 percent of the hydroxynitrocyclohexadienyl radicals disproportionate to produce isomeric nitrophenols and nitrobenzene in N_2O-saturated systems without added oxidants upon irradiation at low dose rates. For a given dose the distribution of nitrophenols was dependent upon the dose rate. Observed dose rate dependence of nitrophenol production and dose rate independence of nitrobenzene consumption indicate that reactions other than disproportionation and dimerization play a significant role at high dose rates. The examination of the effect of added ferricyanide ion in N_2O-saturated systems showed that reliable production measurements of o- and p-nitrophenol cannot be made because

of complicating secondary reactions. The initial yield for the production of m-nitrophenol was higher by a factor of greater than 3 in the presence than in the absence of ferricyanide ion. This result indicates that in the cross disproportionation reaction of m- and o- or p-hydroxynitrocyclohexadienyl radicals the meta isomer acts as an oxidizing agent and ortho and para isomers act as reducing agents. (auth)

6014 DESTRUCTION OF POLYTRIFLUOROCHLORETHYLENE (PTFCE) IN MIXED GAMMA-NEUTRON FIELDS. Knizhnik, E. I.; Nechiporuk, D. Ya.; Lavrentovich, Ya. I. (Inst. of Nuclear Research, Kiev.). Ukr. Khim. Zh.; 41: No. 2, 214-215(Feb 1975). (In Russian).

A study was made of the change in molecular weight as a result of irradiating samples of PTFCE in a reactor at a dose rate of ~0.042 Mrad/sec. It was established that the degree of destruction of the polymer is proportional to the absorbed dose in the interval of zero to 150 Mrad. The radiation destruction yield is equal to 6.61 molecules/100 ev. (SJR)

6015 γ-RADIOLYSIS OF D-GLUCOSE IN AERATED, AQUEOUS SOLUTION. Kawakishi, S.; Kito, Y.; Namiki, M. (Nagoya Univ., Japan). Carbohydr. Res.; 39: No. 2, 263-269(Feb 1975).

γ-Radiolysis of D-glucose in aerated, aqueous solution gives mainly D-glucono-1, 5-lactone, D-arabino-hexosulose, and D-ribo-hexos-3-ulose, together with D-xylo-hexos-4-ulose, D-xylo-hexos-5-ulose, and other pentose, tetrose, and triose derivatives as minor products, which were estimated by mass spectrometry of their alditol-d acetates. These hexose derivatives appear to be produced by the decomposition of D-glucose peroxy-radicals which are formed by the reaction of the primary radicals of D-glucose with oxygen. Bond scission of the peroxy-radicals yields triose, tetrose, and pentose. A radiolysis mechanism for the degradation of D-glucose in aerated, aqueous solution is proposed, based on the reaction of several kinds of D-glucose radical with oxygen. (NL)

6016 PULSE RADIOLYSIS STUDY OF SOME FREE RADICAL REACTIONS WITH ERYTHROCYTE MEMBRANES. Bisby, R. H. (University Park, Nottingham, Eng.); Cundall, R. B.; Wardman, P. Biochim. Biophys. Acta; 389: No. 1, 137-144(Apr 1975).

The reactions of the free radicals e^-_{aq}, OH, and Br_2^- with haemoglobin-free erythrocyte ghost membranes were studied by producing radicals by pulse radiolysis and monitoring their reactions by optical spectroscopy. Hydrated electrons react rapidly with the membrane, but no attack at disulfide links was observed. Hydroxyl radical attack produced transient species absorbing weakly in the ultraviolet, which may arise from carbohydrate residues, such as N-acetyl neuraminic acid and N-acetyl glucosamine, on the membrane surface. No evidence was obtained for OH attack at ring-containing amino acid residues of the protein component. The Br_2^- radical, a more selective electrophile than OH, reacted only slowly with erythrocyte ghosts. Solubilization of the membranes with dodecylsulfate or digestion with alkali exposed protein containing tyrosine and tryptophan residues which reacted with Br_2^-. These results support other evidence for the absence of reactive protein at the membrane surface. (NL)

6017 RADIATION CONVERSION OF HEXENE-1 IN THE ADSORBED STATE. Doroshenko, V. N.; Yatsun, V. V.; Suprunenko, K. A.; Kabakchi, A. M. (Inst. of Physical Chemistry, Kiev). Teor. Eksp. Khim.; 11: No. 1, 115-119(1975). (In Russian).

By electron paramagnetic resonance (EPR) a study was made of the effect of gamma irradiation on the system hexene-1 and silica gel at various ratios of the components. It is shown that H atoms split off from surface OH-groups during irradiation, react with the adsorbed hexene, and produce C_6H_{13} radicals. The participation of hydrogen atoms in the radiation conversions of adsorbed material is also confirmed by experiments with silica gels dehydrated at various temperatures. At large values of adsorbed dose the silica gel surface can initiate the polymerization process. 10 refs. (SJR)

6018 USE OF SODIUM CHLORIDE WINDOWS IN THE INFRARED SPECTRAL ANALYSES OF IRRADIATED THIN INSOLUBLE POLYMER FILMS. Oberbeck, W. F. Jr.; Mayhan, K. G. (Univ. of Missouri, Rolla). Anal. Chem.; 47: No. 7, 1216-1217(Jun 1975).

The infrared spectral quality of the sodium chloride windows was not affected by a mixed flux of gamma radiation in the presence of fast and thermal neutrons. (LK)

6019 γ IRRADIATION OF ADENINE. Identification of Radiolytical Products. Mariaggi, N.; Teoule, R. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Lab. de Radiobiologie). C. R., Ser. C.; 279: No. 25, 1005-1007(16 Dec 1974). (In French).

The effects of γ radiation on adenine in aerated aqueous solutions (4.10^{-3}M/l) (pH neutral) lead to the following radiolytic products: allantoxaidine, cyanuric acid, parabanic acid, triuret, biuret, formyl-urea and cyanoformamidine. The structures of those substances together with that of 8-hydroxy-adenine show the existence of a mechanism involving the attack of C8 and 4-5 double bond of puric ring. (FR)

6020 GAMMA RADIOLYSIS OF THYMIDINE-5' MONOPHOSPHATE IN AERATED AQUEOUS SOLUTIONS. Identification of N(Phospho-5-Desoxy-2-β-D Erythro-Pentofurannosyl) Formamide. Ducoulomb, R.; Teoule, R. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Lab. de Radiobiologie). C. R., Ser. C.; 279: No. 13, 549-551(23 Sep 1974). (In French).

The irradiation of thymidine-5' monophosphate in aerated aqueous solutions leads to the production of phosphoric acid and γ-desoxy-ribonolactone phosphate and N(phospho-5 desoxy-2-β-D-erythro pentofurannosyl) formamide (G = 1,2). The release of thymine and radiolytical derivatives is due to the rupture of the N-glycosidic link. (FR)

6021 ACID AND ENZYMATIC HYDROLYSES OF THE THYMINE FRAGMENT MODIFIED AND BOUND TO THE POLYNUCLEOTIDE CHAIN AFTER γ IRRADIATION OF E. COLI DNA IN VITRO. Teoule, R.; Bonicel, A.; Bert, C.; Cadet, J.; Polverelli, M.; Fouque, B. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Lab. de Radiobiologie). C. R., Ser. D.; 279: No. 23, 1797-1799(2 Dec 1974). (In French).

The changes produced in situ on the thymine fragment of the E. Coli DNA chain by γ irradiation of aqueous solutions in vitro were determined by acid and enzymatic hydrolyses. In aerated solution the thymine fragment is partially transformed into cis dihydroxy-5,6 dihydrothymine I, trans dihydroxy-5,6 dihydrothymine II, hydroxy-5 methyl-5 hydantoine III. In deaerated solution, products I and II, hydroxy-5 dihydrothymine IV, hydroxy-6 dihydrothymine V and dihydro-5,6 thymine VI are formed. The modified bases were identified by specific microreactions after hydrolysis and chromatographic separation. (FR)

6022 RADIATION CHEMICAL ISOMERIZATION OF CYCLOHEXANE INTO METHYLCYCLOPENTANE. Wojnarovits, L.; Foldiak, G. (Inst. of Isotopes, Budapest). Radiochem. Radioanal. Lett.; 21: No. 3-4, 261-269(10 May 1975).

The composition of C_6 and C_{12} products involving ring fission produced from irradiated liquid cyclohexane with ^{60}Co γ-radiation at room temperature was studied. Of C_{12} products n-hexyl-cyclohexane was found in largest amounts /G = 0.08/, and not 6-cyclohexyl-1-hexene /G = 0.03/, as had been reported earlier. Of C_6 products, 1-hexene /G = 0.36/ and methylcyclopentane /G = 0.20/ were formed with highest yields. Methylene-cyclopentane /G = 0.005/ as well as cyclopentyl-cyclohexylmethane /G = 0.03/ have also been observed. C_5-cyclic products were produced presumably via skeletal rearrangement of cyclohexyl radicals possessing sufficient energy. (auth)

6023 EFFECT OF BROMINE ON THE γ-RADIOLYSIS OF LIQUID 1,1,2-TRICHLOROTRIFLUOROETHANE. Tominaga, T.; Fukumizu, T.; Makide, Y. (Univ. of Tokyo). Radiochem. Radioanal. Lett.; 21: No. 3-4, 211-217(10 May 1975).

The products in γ-irradiated 1,1,2-trichlorotrifluoroethane with bromine scavenger were studied by gas chromatography. The plateau G values of the scavenged products reveal that the C-Cl bond rupture is preferred to the C-C rupture, and the C-F rupture is the least likely in the γ radiolysis of this compound. (auth)

6024 PULSE RADIOLYSIS OF METHANE SULFONIC ACID. Lind, J.; Eriksen, T. E. (Royal Inst. of Technology, Stockholm). Radiochem. Radioanal. Lett.; 21: No. 3-4, 177-181(10 May 1975).

Optical absorption and electrical conductivity measurements were performed to study the pulse-radiolysis of aqueous solutions of methane sulphonic acid. A transient absorption at 250 nm, which is constant in the pH range 1 to 10, is assigned to the radical $\dot{C}H_2SO_3^-$. $\dot{C}H_2SO_3^-$ is formed by OH· abstracting H· from the methyl group and recombining to form $(CH_2SO_3^-)_2$, $2k = (1.4 \pm 0.2) \times 10^9$ dm^3 mol^{-1}s^{-1}. (auth)

6025 THERMAL DECOMPOSITION OF POTASSIUM PERMANGANATE AT SIMULTANEOUS γ-IRRADIATION. Sugier, H.; Phuong, N. T. H. (Technical Univ., Lodz, Poland). Radiochem. Radioanal. Lett.; 21: No. 3-4, 121-128(10 May 1975).

The thermal decomposition of potassium permanganate without any additives and in mixtures with cuprous and zinc oxides, with simultaneous ^{60}Co γ-irradiation was examined. The radiation increased the rate of thermal decomposition of potassium permanganate and the combined action of radiation and the added oxide differed in sign depending on the nature of the additive. (auth)

6026 EPR SPECTRA OF IRRADIATED, SINGLE CRYSTAL, CHLORHYDRATE OF 1-GLUTAMIC ACID. Bikchantaev, I. G.; Rivkind, A. I. (Kazan Physical-Technical Inst.). Teor. Eksp. Khim.; 11: No. 1, 132-136(1975). (In Russian).

A study was made of the EPR spectra of single crystal, chlorhydrate of 1-glutamic acid irradiated with x rays. From a spectrum consisting of more than 16 lines, after heating the crystals to ~110°C it was possible to separate out 8 lines belonging to a radical in which an unpaired electron interacts with three equivalent protons. The EPR spectrum was found to be consistent with the actual presence of radical I: $HOOC-\dot{C}H-CH_2-CH(NH_3 + Cl^-)-COOH$ (I). The main eigenvalues of the tensor vector of this radical were determined. On forming radical I the alpha proton changes its position (in comparison with the position in the undamaged molecule), and passes over into the plane of the valence bonds of the alpha carbon. The unpaired electron is localized on the alpha carbon with the axis of the p_z-orbital of this electron being perpendicular to the plane of the three valence bonds of the alpha carbon. The orientation of the hydrogen composition of radical I in the crystal lattice is the same as in the undamaged molecules. (7 refs) (SJR)

6027 CONFORMATIONAL CHANGES OF MACROMOLECULES OF GRAFTED COPOLYMERS OF ACETYLCELLULOSE CONTAINING POLYVINYLPYRROLIDONE IN SOLUTIONS. Tashmukhamedov, S. A.; Sagdullaev, B. U.; Tillaev, R. S. (Tashkent State Univ.). Uzb. Khim. Zh.; No. 3, 45-47(1973). (In Russian).

A study was made of the characteristic viscosity of acetylcellulose (AC) containing polyvinylpyrrolidone (PVP) in dimethylformamide and acetic acid at various temperatures. In both solvents the viscosity of the grafted copolymers decreases by passing through a maximum at 35 and 30°C respectively, while the viscosity of the corresponding homopolymers varies monotonically. The anomalous changes of the viscosity of the grafted copolymers as a function of temperature are caused by a change in configuration of the branched structure of the grafted copolymer which consists of segments of a different chemical nature. The type of interaction of these segments depends on the nature of the solvent and the temperature, which has a significant effect on the flexibility of the main and side chains of the grafted copolymer. (SJR)

6028 STUDY OF THE BEHAVIOR OF GOSSYPOL ON IRRADIATING WITH HIGH DOSES OF GAMMA RADIATION. Muminova, S. N.; Rizaev, N. U.; Mirzakarimov, R. M.; Sultanov, A. (Tashkent Polytechnic Inst.). Uzb. Khim. Zh.; No. 3, 28-30 (1973). (In Russian).

A study was made of the effect of high doses of gamma radiation on gossypol produced from cottonseed kernels. Gossypol at a concentration of 4 g/l was irradiated at a dose rate of 4500 r/sec to a total dose of 1×10^8 to 3.8×10^8 r in a neutral solution of ethyl alcohol contained in a sealed ampule. The labile compounds that were formed are separated out by gel-filtration on a Sephadex LN-20 column. Three fractions which were obtained were characterized from uv-spectra taken on a SF-4 instrument. A comparison of these absorption spectra in the uv-region of the separate fractions confirms the structural changes taking place in gossypol during gamma irradiation. (SJR)

6029 MODIFYING THE PROPERTIES OF CHLORINATED POLYVINYLCHLORIDE (PVC) BY RADIATION GRAFTING OF VINYLIDENE FLUORIDE (VF_2) FROM A LIQUID PHASE. Musakhanova, S. M.; Asamov, M. K.; Yul'chibaev, A. A.; Luk'yanov, V. I. (Tashkent State Univ.). Uzb. Khim. Zh.; No. 2, 66-68 (1973). (In Russian).

Grafting of vinylidene fluoride (VF_2) to chlorinated PVC is carried out by a radiation method from a liquid phase in the presence of 1,1-dichlorethane. The rate of grafting was found to be a function of dose rate raised to 0.66 power. The grafted copolymers are found to have a higher thermal stability. (SJR)

6030 KINETICS AND MECHANISM OF AZIBENZYL RADIOLYSIS IN BENZENE SOLUTION. Oncescu, T.; Contineanu, M. (Univ., Bucharest). Rev. Roum. Chim.; 19: No. 10, 1559-1567 (Oct 1974).

The radiolysis of benzene solutions of azibenzyl was studied in the concentration range $3 \times 10^{-1} - 3 \times 10^3$ mole/l and a first-order kinetics was found. A reaction mechanism was suggested which involves the energy transfer processes from irradiated-excited benzene molecules to dissolved azibenzyl molecules. (auth)

6031 RADIOLYSIS OF THE COMPLEX OXALATES IN AQUEOUS SOLUTIONS. IV. The Influence of Some Reducing Free Radical Scavengers on the Potassium Trisoxalatocobaltate Radiolysis in Aqueous Solutions. Memetea, T.; Paun, J. (Univ., Bucharest). Rev. Roum. Chim.; 19: No. 11, 1689-1694(Nov 1974).

The radiolysis of $[Co(C_2O_4)_3]^{3-}$ complex ion in aqueous solution in various conditions, the presence and the absence of air, neutral and acid medium and the presence of some reducing species scavengers such as NO_3^-, NO_2^-, N_3^- ions and acetone has been studied. At 2×10^{-3}M concentration the radiochemical yield $G(-[Co(C_2O_4)_3]^{3-}) = 4.96 \pm 0.05$ in the absence of air, and 3.19 ± 0.05 in the presence of air. At the same complex concentration, $G(-[Co(C_2O_4)_3]^{3-})_{pH=1} = 5.62$. In the absence of air the reduction takes place by the reactions with hydrated electron and hydrogen atom. In the presence of air the complex ion is reduced by O_2^- ion. (auth)

6032 STUDY OF INFRARED AND NMR SPECTRA OF TERNARY COPOLYMERS OF VINYL FLUORIDE (VF) CONTAINING VINYL CHLORIDE (VC) AND VINYL ACETATE (VA). Aslanova, R.; Yul'chibaev, A. A.; Usmanov, Kh. U. (Tashkent State Univ.). Uzb. Khim. Zh.; No. 3, 31-33(1973). (In Russian).

Studies were made of the infrared and NMR spectra of ternary copolymers of vinylfluoride (VF) containing VC and VA by comparison with spectra of a binary copolymer of vinylchloride (VD) containing vinylacetate (VA), and also of separate homopolymers and mechanical mixtures of these polymers. In the spectrum of a mechanical mixture consisting of 16.7% vinyl fluoride, 41.3% polyvinyl chloride and 42% polyvinyl acetate, observations were made of all the characteristic bands of the separate components which differed in intensity from the corresponding bands in the copolymer. In infrared spectra of the binary copolymer of VC containing VA there are bands of 600 to 660 cm^{-1} of valence oscillations of the C-Cl bond, and an intense band of 760 cm^{-1} which is absent in spectra of a mechanical mixture and of polyvinyl acetate. As a result of introducing a third component (vinylfluoride) into the composition of the binary copolymer, the intensity of the valence oscillations of the C-Cl bond decreases sharply, and the bond in the region of 1000 to 1200 cm^{-1} is expanded because of the presence of valence oscillations of the C-F bond and of a complex ether group (1740 cm^{-1}). In the NMR-spectra of the ternary copolymers, which differ in the character of the protons, observations were made of three groups of signals (1.7 to 2.5, 4.0 to 4.7 and 4.9 to 5.6 M.D.), whose relative intensity depends on the composition of the copolymer. (SJR)

6033 HYDROXYL RADICAL INDUCED OXIDATION OF NITROBENZENE. Bhatia, K. (Carnegie-Mellon Univ., Pittsburgh). J. Phys. Chem.; 79: No. 10, 1032-1038(1975). (RRL-3238-490).

The hydroxylation of nitrobenzene by radiolytic techniques was examined by high-performance liquid chromatographic techniques. Owing to improvements in the method of analysis it was possible to measure phenol in air-saturated nitrobenzene solutions irradiated to low doses. The initial yields for the consumption of nitrobenzene and the formation of phenol and isomeric nitrophenols in N_2O- and air-saturated systems were measured in order to establish the primary reactions of hydroxyl radicals with nitrobenzene. The initial yields for the consumption of nitrobenzene were 3.7 and 2.6 and that for total phenol were 2.3 and 2.4 in N_2O- and air-saturated systems, respectively, in samples irradiated at low dose rates (0.8 krad g^{-1} min^{-1}). Nearly 80% of the hydroxynitrocyclohexadienyl radicals disproportionate to produce isomeric nitrophenols and nitrobenzene in N_2O-saturated systems without added oxidants upon irradiation at low dose rates. For a given dose the distribution of nitrophenols was dependent upon the dose rate. Observed dose rate dependence of nitrophenol production and dose rate independence of nitrobenzene consumption indicate that reactions other than disproportionation and dimerization play a significant role at high dose rates. The examination of the effect of added ferricyanide ion in N_2O-saturated systems showed that reliable production measurements of o- and p-nitrophenol cannot be made because of complicating secondary reactions. The initial yield for the production of m-nitrophenol was higher by a factor of >3 in the presence than in the absence of ferricyanide ion. This result indicates that in the cross disproportionation reaction of m- and o- or p-hydroxynitrocyclohexadienyl radicals the meta isomer acts as an oxidizing agent and ortho and para isomers act as reducing agents. (auth)

6034 EFFECT OF DOUBLE BONDS ON THE GAMMA-RADIATION-INDUCED CROSSLINKING OF POLYETHYLENE. Mitsui, H. (Japan Atomic Energy Research Inst., Takasaki); Hosoi, F.; Ushirokawa, M. J. Appl. Polym. Sci.; 19: No. 2, 361-369(Feb 1975).

Various low-density polyethylenes ranging in initial weight-average molecular weight from 7600 to 589,000 having a ratio of weight-average molecular weight to number-average molecular weight of about 5 were irradiated by gamma rays in vacuo at

30°C. Gel fractions were determined and analyzed by using the equation derived by Charlesby and Pinner. The gel point dosage (Mrad), the sum of the initial contents of terminal vinyl and vinylidene unsaturations (mole/g polyethylene), and probabilities of crosslinking and main-chain scission per monomer unit for a unit radiation dose in Mrad. It was concluded that terminal vinyl and vinylidene unsaturations play an important role for the gel formation in the gamma-radiation-induced crosslinking of polyethylene in vacuo at room temperature. (auth)

6035 GRAFTING ON POLYESTER FIBERS. Kale, P. D. (Univ. of Bombay); Lokhande, H. T.; Rao, K. N.; Rao, M. H. J. Appl. Polym. Sci.; 19: No. 2, 461-480(Feb 1975).

Acrylic acid (AA) and acrylonitrile (AN) were used to carry out grafting on polyester (PE) fibers using the techniques of initiation by gamma-radiation as well as benzoyl peroxide. The nature of the grafted fiber substance was found to be the same, irrespective of the grafting technique. Extent of grafting depended upon the time, concentration of the initiator, and the monomer as well as on the irradiation dose. The increase in the moisture regain was directly proportional to the amount of graft in the fiber. AA grafted fibers were rendered more hydrophilic than AN grafted fibers for equivalent amount of grafts. Considerable improvement in dyeability of the the PE fibers was possible through grafting. About 50 percent to 100 percent improvement with disperse dyes was observed in case of PE fibers containing 22.4 percent and 9.0 percent graft of AA and AN, respectively. Intense fast dyeing with direct and basic (cationic) dyes was also possible, and the dye content was proportional to the extent of graft introduced in the fiber. The CN groups were reduced to NH_2 groups in the AN graft on the fiber. In this way, deep, fast, and bright dyeing was obtained with reactive dyes. Electrokinetic studies were carried out on the grafted fibers. With the increased amount of AA graft, the maxima in the zeta potential curve shifted toward higher acidic pH as greater amounts of alkali was utilized by the –COOH groups in the graft. In this respect, CN groups were less sensitive due to their lesser polarity as compared to the carboxylic groups. It was observed from surface charge density (S,C,D,) studies that the effective surface area of the fiber decreased with the increase in the amount of graft, particularly in case of AN graft. Surface conductivity (S,C,) studies revealed that with increase in the number of polar groups (–COOH) on the surface of the fiber, the S,C, increased with the increase in the amount of AA graft. In case of AN grafts, the reduction in effective surface area of the fiber played a more important role than the contribution by the CN groups to surface conductivity. (auth)

6036 GAMMA RAY-INDUCED GRAFT COPOLYMERIZATION OF ACRYLAMIDE AND ACRYLIC ACID TO NYLON 6 FABRIC. Trivedi, I. M. (Ahmedabad Textile Industry's Research Association, India); Mehta, P. C.; Rao, K. N.; Rao, M. H. J. Appl. Polym. Sci.; 19: No. 1, 1-14(Jan 1975).

Kinetics of radiation-induced grafting of acrylamide (Aam) and acrylic acid (Aa) to nylon 6 fabric were investigated employing a mutual radiation technique. Copper sulfate was used as the radical scavenger to reduce homopolymer formation. Formic acid was used for swelling, and its effect on grafting was studied. Maximum amount of grafting was doubled when formic acid was used for swelling nylon prior to, but not during, irradiation. The rate of grafting was not significantly affected if it was carried out in an atmosphere of air instead of nitrogen. The effect of monomer concentration, dose rate, and total dose on grafting has been studied. Rate of grafting was significantly higher when lower dose rates and monomer concentrations were used. Saturation grafting was proportional to monomer concentration up to 2.1M. Initial rate of grafting was proportional to monomer concentration. The rate of grafting of Aam was proportional to the dose rate to the power 0.25 - 1.0. A synergestic effect was noticed during grafting with mixtures of Aam and Aa (80:20; 20:80). Grafted fabrics showed considerable increase in moisture regain. Dyeability and tensile properties of the grafted fabrics were not significantly affected by grafting. Aa-grafted fabrics did not melt up to 320°C, whereas untreated nylon melts at 215°C. (auth)

6037 GEL PERMEATION CHROMATOGRAPHY OF POLYSULFONS. Boden, M. J.; Thompson, L. F. (Bell Labs., Murray Hill, NJ). J. Appl. Polym. Sci.; 19: No. 3, 905–906(Mar 1975).

Results of gel permeation chromatography studies on molecular weight distributions of poly(butene sulfone) as a function of γ-radiation dose are presented. (JGB)

Radiochemistry and Nuclear Chemistry

Refer also to abstracts 5918 and 8419.

6038 RADIOCHEMISTRY. Maddock, A. G. (ed.). International Review of Science, Inorganic Chemistry. Series Two, Volume 8. London; Butterworths (1975). 334p.

The volume contains reviews covering the following subjects: muonium; chemical reactions of nuclear recoil particles in gases and liquids; measurement techniques and instrumentation; simple high-energy reactions on complex nuclei; superheavy elements; chemical effects of nuclear transformations in solids. All the reviews were in NSA scope, and separate abstracts were prepared for the 6 of them. (UK)

For abstracts of individual sections see: 6042, 6043, 6074, 6505, 7432, and 7846.

6039 TRACER METHODS. Raaen, V. F. (Oak Ridge National Lab., TN). pp 257-284 of Investigation of Rates and Mechanisms of Reactions. Part I. Lewis, E. S. (ed.). New York; John Wiley and Sons, Inc. (1974).

The general analytical applications of isotopic tracers are briefly reviewed. The application of tracer techniques to reaction-mechanism studies which would be difficult or even impossible without the use of tracers is examined. Practical information on the purchase and preparations of labelled compounds and the applications of the most commonly used radioactive and stable isotopic tracers is discussed. (67 references) (JSR)

Hot-Atom Chemistry

Refer also to abstract 7790.

6040 (JINR-P6-8651) CHEMICAL STATES OF RADIOACTIVE LANTHANIDE ATOMS IN Pr AND Nd FLUORINATED BETA-DIKETONATES. Gromova, I. I.; Zaitseva, N. G.; Islamova, Kh. M.; Lebedev, N. A. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 16p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

An investigation was carried out of the chemical behavior of radioactive lanthanide atoms formed in Pr and Nd trifluoracetylacetonates and Pr and Nd hexafluoracetylacetonates irradiated with 660-MeV protons, and of those resulting from the implantation of the $Ln^{*(1+)}$ ions with an energy of 40 keV into crystalline $Nd(HFA)_3$. The experimental conditions, namely the chemical composition of the medium and the state of the crystalline lattice, appear to be important factors affecting the chemical reactions of the Ln* atoms and the forms of their stabilization. Some results characterizing the behavior of the Ln* atoms introduced into crystalline $Nd(HFA)_3$ in different ways (by proton irradiation or ion implantation) indicate that the behavior of radioactive Ln atoms is independent of energy. (auth)

6041 CHEMICAL CONSEQUENCES OF LOW ENERGY I^+ OR I_2^+ IMPLANTATION IN SOLID HYDROCARBONS. Cailleret, J.; Paulus, J. M.; Abbe, J. C. (Centre National de la Recherche Scientifique, Strasbourg). J. Chem. Soc., Faraday Trans., I; 71: No. 3, 637-646(1975).

I^+ and I_2^+ ions, produced by electron bombardment of iodine vapour in a specially designed mass spectrometer, were allowed to strike thick solid hydrocarbon targets (propane, n- and isobutane, n-pentane and benzene) at 77°K. The organic iodides formed were analysed with a gas chromatograph equipped with an electron capture detector. The total and relative yields were determined as a function of the beam energy from 5 to 3000 eV. The reaction mechanism involves cage effects which favour the recombination of iodine with one of the free radicals formed in the close vicinity of the thermalized halogen, after the slowing down and the neutralization of a beam component. The contribution of charge transfer reactions is important in the low energy region and with alkane targets, increasing steadily from pentane to butane and to propane but playing a minor role with C_6H_6. Accelerated iodine ions, (n,γ) activated ^{128}I, and ^{125}I formed in the electron capture of ^{125}Xe lead to similar results with solid alkanes hence weakening the validity of the autoradiolysis model. This similarity does not appear however with a more radiation-resistant compound such as C_6H_6, the yields of C_6H_5I in I^+ irradiated targets being one order of magnitude lower than those obtained after nuclear transformations. These discrepancies must be attributed to the radiolytic effects brought about in the formation of nucleogenetic hot atoms, especially by Auger electrons. (auth)

6042 CHEMICAL REACTIONS OF NUCLEAR RECOIL PARTICLES IN GASES AND LIQUIDS. Urch, D. S. (Queen Mary Coll., London). pp 49-104 of Radiochemistry. Maddock, A. G. (ed.). London; Butterworths (1975).

The subject is reviewed in chapters entitled: theory (hot-atom-molecule collisions); recoil tritium; recoil fluorine; chlorine; bromine; iodine; elements from group VI (oxygen, sulphur, selenium); elements from group V (nitrogen, phosphorus, arsenic);

recoil carbon; other elements, group IV (silicon, germanium); transition metals (chromium, iron, cobalt, nickel). (UK)

6043 CHEMICAL EFFECTS OF NUCLEAR TRANSFORMATIONS IN SOLIDS. Maddock, A. G. (Cambridge Univ., Eng.). pp 273-327 of Radiochemistry. Maddock, A. G. (ed.). London; Butterworths (1975).

The subject is reviewed in chapters, entitled: physical investigations; direct determination of the fragmentation energy; the n,γ reaction in oxyanions; n,γ effects in metal complexes; n,γ effects in complex halo anions; n,γ effects in organometallic compounds; n,γ effects in metal phthalocyanines; annealing and solid-state exchange; n,γ effects in double complexes; annealing kinetics and mechanism; effects of isomeric transitions; effects of β decay; nuclear reactions leading to very large recoil energies; processes in simple chlorides (phosphorus, sulfur); ion implantation; applications to the enrichment of radioactive products. (UK)

Properties of Radioactive Materials

Refer also to abstracts 5913, 5949, 6370, 6424, 6930, and 8046.

6044 (BNWL-SA-5375) ISOTOPIC COMPOSITION AND RADIOLOGICAL PROPERTIES OF URANIUM IN SELECTED FUEL CYCLES. Fleischman, R. M.; Liikala, R. C. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Apr 1975. 28p. (CONF-750445-5). Dep. NTIS $4.50.

From conference on occupational health experience with uranium; Arlington, Virginia, USA (28 Apr 1975).

Three major topic areas are discussed: First, the properties of the uranium isotopes are defined relative to their respective roles in the nuclear fuel cycle. Secondly, the most predominant fuel cycles expected in the U. S. are described. These are the Light Water Reactor (LWR), High Temperature Gas Cooled Reactor (HTGR), and Liquid Metal Fast Breeder Reactor (LMFBR) fuel cycles. The isotopic compositions of uranium and plutonium fuels expected for these fuel cycles are given in some detail. Finally the various waste streams from these fuel cycles are discussed in terms of their relative toxicity. Emphasis is given to the high level waste streams from reprocessing of spent fuel. Wastes from the various fuel cycles are compared based on projected growth patterns for nuclear power and its various components. (auth)

6045 (CEA-CONF-2757) LABELLING OF DRUGS WITH CARBON 11. Advantage in Nuclear Medicine. Maziere, M.; Marazano, C.; Comar, D. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Biologie). 1974. 20p. (In French). INIS.

From 16th French language symposium on nuclear medicine; Clermont-Ferrand, France (6 Jun 1974).

A summary is presented on laboratory research work undertaken on the use of carbon-11 to label drugs having an affinity for certain organs, so as to enable them to be visualised by means of a gamma camera. The molecules are labelled by two different methods: formation of quaternary ammonium by the action of $I^{11}CH_3$ on a tertiary amine (e.g. chlorpromazine iodomethylate ^{11}C; methylation by action on N-demethylated molecules of formic aldehyde ^{11}C (e.g. chlorpromazine ^{11}C -Imipramine ^{11}C - Majeptil ^{11}C - Nicotine ^{11}C) and of methyl iodide ^{11}C (e.g. Valium ^{11}C - Caffeine ^{11}C). These various syntheses are made by a continuous process and in a time lapse always less than two periods (20 to 40 minutes). Radiochemical purity is controlled by thin layer radiochromatography; the labelled compounds are placed in physiological solution and sterilized by filtration on a millipore membrane. Sequential images obtained with the gamma camera after intravenous injection of these molecules in animals and man show their in vivo distribution in the organism. In parallel their studies on animals after removal of the organs make it possible to quantify their distribution. (FR)

6046 (CEA-CONF-2917) DECONTAMINATION AND INTERVENTION IN THE HOT LABORATORIES. Lachambre, A.; Veau, J. M.; Fignon, M.; Mansard, B ; Lefevre, J. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Service des Piles). 1974. 12p. (In French). INIS.

From 16th Euratom working group on hot laboratories; Winfrith, UK (18 Sep 1974).

The techniques currently used in the various CEA research laboratories are described, the advantages of each technique as a function of the problems posed are pointed out, and their field of application mentioned. (FR)

6047 (LF-49, pp 1-7) PRODUCTION OF MONODISPERSE RESPIRABLE AEROSOLS OF $^{241}AmO_2$ AND EVALUATION OF IN VITRO DISSOLUTION. Boyd, H. A.; Raabe, O. G.; Peterson, P. K. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973–1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

A method is described for production of monodisperse (sigma /sub g/ less than 1.2) particles of $^{241}AmO_2$ for use in inhalation experiments with dogs and rodents. The effects of physical and chemical factors on the production of polydisperse aerosols of $^{241}AmO_2$ were studied and evaluated. The best aerosol was achieved when a suspension of americium hydroxide with 2.5 mg Am/ml at pH equals 7.3 was aerosolized and passed through two heating columns in succession, the first at 300°C and the second at 1050°C. The particles were roughly spherical and had densities near 8 gm/cm^3; the aerosol AMAD and sigma/sub g/ were about 1.5 mu m and 1.7, respectively. Monodisperse particles were separated and collected with the Lovelace Aerosol Particle Separator (LAPS) and subsequently suspended in deionized water with pH adjusted to 10.2 with NH_3 for nebulization to produce monodisperse aerosols for inhalation exposures. Particles collected on filters during inhalation experiments were used for evaluation of in vitro dissolution rates with two systems and various forms of a lung fluid simulant. The important role of phosphate ions in such dissolution systems was demonstrated, suggesting the potential for the equally important role of free phosphate in retarding dissolution of AmO_2 particles in the lung. (auth)

6048 (LF-49, pp 8-11) PREPARATION OF MONODISPERSE GALLIUM-67 LABELED ALUMINOSILICATE AEROSOLS FOR DEPOSITION AND EARLY PARTICLE CLEARANCE STUDIES IN LABORATORY ANIMALS AND MAN. Newton, G. J.; Raabe, O. G.; Yarwood, R.; Kanapilly, G. M. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973–1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

A system was designed, constructed, tested, and used to produce monodisperse (sigma/sub g/ less than 1.2) submicrometer particles of ^{67}Ga-labeled aluminosilicate spheres for inhalation deposition studies in man and experimental animals and other experiments where short-lived, radioactive, monodisperse aerosols are useful. Aerosol generation and particle separation equipment for preparing the monodisperse particles is housed in a system of five stainless steel glove boxes. The primary polydisperse aerosol of ^{67}Ga-labeled clay particles is passed via a quartz tube through a high temperature furnace (1200°C) where the clay is converted into insoluble aluminosilicate spheres entrapping the ^{67}Ga in the particles. Two Lovelace Aerosol Particle Separators are used to separate the polydisperse aerosol into monodisperse fractions and collect them onto stainless steel foils. Monodisperse particles are then suspended in water and nebulized to provide monodisperse aerosols in the respirable size range between 0.6 mu m and 3.5 mu m aerodynamic diameter. (auth)

6049 (LF-49, pp 12-14) ELECTROSTATIC CHARGE DISTRIBUTION OF ^{198}Au-LABELED MONODISPERSE GOLD AEROSOLS. Yeh, H. C.; Newton, G. J.; Boor, D. R.; Raabe, O. G. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973–1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

Knowledge of the electrostatic properties of an aerosol may be essential in assessing its potential inhalation hazard. In inhalation studies with radioactive aerosols, the aerosol charge status may change in the course of transport due to the emission of alpha, beta, or gamma radiations. Electrostatic properties of an aerosol may also affect the performance of aerosol sampling devices and lead to false interpretation of the aerosol characteristics. A study was made of the self-charging of ^{198}Au-labeled aerosol of monodisperse gold spheres due to the beta particles emitted by the label. A miniature aerosol charge and electrical mobility spectrometer was used. Some preliminary results are presented indicating that specific activity of the aerosol can affect the charge distribution. (auth)

6050 (LF-49, pp 21-23) PRECIPITATION BEHAVIOR OF TRIVALENT LANTHANIDES, Ln(III) IN VITRO. Kanapilly, G. M. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973–1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

In vitro precipitations of Ln(III) were studied to provide some insight into the relative importance of various factors in the in vivo precipitation of inhaled, alveolar deposited Ln(III). The effects of precipitants, ligands, carrier, and pH on the in vitro precipitation of one or more Ln(III) were studied. Results of the in vitro experiments suggest that the possible precipitation of Ln(III) in the alveoli may be as Ln(III) phosphate. (auth)

6051 (LF-49, pp 24-28) CHARACTERIZATION OF PLUTONIUM AEROSOLS FROM AN INDUSTRIAL MIXED-OXIDE FUEL

FABRICATION FACILITY. Raabe, O. G.; Newton, G. J.; Smith, R. C.; Wilkinson, C. J.; Teague, S. V. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973–1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

Samples of the aerosols present in a glove box during a plutonium oxide and uranium oxide powder mixing operation were taken with a small seven-stage cascade impactor to determine the aerodynamic size distribution and concentration and with a Lovelace Aerosol Particle Separator (LAPS) to study the characteristics of the particles with respect to aerodynamic equivalent size. Using alpha spectroscopy, it was found that about 11 percent of the alpha activity of the aerosol was associated with ^{241}Am. The size distributions measured with the cascade impactor had activity median aerodynamic diameters (AMAD) equal to 1.9 +- 0.3 (S.D.) mu m and geometric standard deviations (sigma/sub g/) equal to 1.59 +- 0.07 with alpha activity concentrations best expressed as log-normally distributed with median of 45 nCi/l and geometric standard deviation of 1.8. (auth)

6052 (LIB/Trans-544) SORPTION OF PLUTONIUM AND CURIUM ON ION EXCHANGE RESINS IN MIXED AQUEOUS ORGANIC SOLUTIONS. Haidvogel, N.; Reitsamer, G.; Grass, F. Translated by P. Holland from Atomkernenergie; 22: No. 2, 117-127(1973). 27p. Dep. NTIS (U. S. Sales Only) $4.50.

The sorption of the sulfate and nitrate complexes of the actinides Pu(III), Pu(IV), Pu(VI), Am(III) and Cm(III) on the ion-exchange-resins Dowex 1X8 and Dowex 50WX8 is investigated. The strong sorbability of these actinide ions in solvents with high content of alcohol is explained by the existence of anionic complexes like $Pu(III)(SO_4)^{2-}$, $Pu(IV)(SO_4)_3^{2-}$, $Pu(VI)O_2(SO_4)_3^{4-}$, $Am(SO_4)^{2-}$ on $Am(NO_3)^{4-}$ and $Cm(NO_3)^{4-}$. The taking of autoradiographs from the thin-layer chromatograms by the aid of a special device and the evaluation of the autoradiographs by a particular photodensitometer are described. The measurement of the radioactivity of the α-emitting nuclides ^{239}Pu, ^{241}Am and ^{242}Cm are done by liquid-scintillation spectrometry. (auth)

6053 (NIRS-R-2, pp 89-92) THE PRODUCTION OF ^{18}F LABELLED ORGANIC COMPOUNDS. Ido, T.; Kashida, Y.; Fukushi, K.; Nozaki, T. Nov 1973. (In Japanese).

In first report on the cancer therapy with high energy particles and the utilization of short lived radionuclides in diagnostics. (National Inst. of Radiological Sciences, Chiba (Japan)).

The basic technique of synthesis of ^{18}F-labeled organic compounds was exploited in order to exploit its uses as a drug for clinical diagnosis. A cyclotron was used for gas irradiation, and oxygen, water, and neon gas were selected as targets. Target box was used for each gas. With respect to synthesis of ^{18}F-labeled organic compounds, labelings of ^{18}F by halogen exchange and Schiemann reactions are discussed. In the synthesis of ^{18}F-benzotrifluoride, ^{18}F obtained by oxygen gas method was used. Its radiochemical yield was 20 to 30% and specific activity was 1 mCi/g. Sodium ^{18}F-m-trifluoromethylbenzene sulfonate was synthesized under cooling at 10-20° to protect the decomposition into $H^{18}F$ and benzoic acid during the reaction. The synthesis of sodium ^{18}F-P-fluorobenzoate by the oxygen gas method and neon gas method is described. The yield of the former was 10-20% and its specific activity was 1 mCi/g. The yield by the latter method was 15-18% and the specific activity was 1 mCi/g. The operation time of the latter was 30 minites as compared with 80 minites of the former. ^{18}F-cholesteryicluoride was synthesized by using $Ag^{18}F$ labeled by oxygen gas method. Its yield was 1-5% and specific activity was 0.5 mCi/g. (JA)

6054 (SAAS-171) REPORTS OF THE STATE MINISTRIES FOR ATOMIC SAFETY AND RADIATION PROTECTION OF THE DDR. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)). Nov 1974. 30p. (In German). Dep. NTIS (US Sales Only) $4.50.

Two reports, one on decontaminability of fibers and the other on transport of nuclear fuels, are compiled. Separate abstracts were prepared for each. (JSR)

For abstracts of individual papers see: 6055 and 7249.

6055 (SAAS-171, pp 2-13) EFFECTS OF FINISHING AND TYPE OF CONTAMINATION ON THE DECONTAMINABILITY OF COTTON, POLYESTER, AND MIXED FABRICS. Unger, H.; Foerschner, R. Nov 1974. (In German).

In reports of the State Ministries for atomic safety and radiation protection of the DDR.

The decontaminability of differently finished cotton, polyester and mixed fabrics was examined. As a rule hydrophobic fabrics show a better decontaminability than crease-resistant ones. Optimum conditions for decontamination can be achieved with finishes on the basis of perfluoro carbon compounds which, moreover, show a good fastness to washing. In general dried soluble contamination is easier to remove than insoluble matter. Using acid detergent solutions soluble contamination can be nearly completely removed even after repeated contamination/decontamination cycles whereas in the case of insoluble contaminants the decontamination efficiency is only about 50%. The effect of alkaline detergent solutions significantly depends on the type of fabric. After five contamination/decontamination cycles the residual insoluble contamination increased up to about 90% with cotton fabrics and up to about 20% with mixed fabrics. (auth)

6056 SELF-DECOMPOSITION OF IODINE-125-LABELLED HUMAN LUTEINIZING HORMONE. Cerceo, E. (Thomas Jefferson Univ., PA). Radiat. Eff.; 24: No. 2, 133-140(1975).

A measure of the rate of self-decomposition of human luteinizing hormone (HLH) labelled with iodine-125 has been determined as a function of time at -10°C, 22°C, and 37°C. Particular attention was given to the data at -10°C, as this has been the recommended storage temperature of the tagged hormone used as a tracer in the radioimmunoassay of HLH. A standard procedure was used to iodinate the hormone, and the corresponding data from it indicated 3.7 to 4.7 iodine-125 atoms per molecule of luteinizing hormone. Chromatography of HLH-^{125}I on columns of Sephadex G-100 dextran gel as a function of storage time indicated lower molecular weight degradation products as well as polymerized species. It was surmized that these reactions were essentially the result of primary and secondary radiation effects leading to a variety of radiolysis products along with the normal chemical breakdown. (auth)

6057 STRUCTURE OF URANYL COMPLEXES WITH O,O'-DIOXYAZOCOMPOUNDS. Karyakin, A. V.; Nemodruk, A. A.; Myasoedov, B. F.; Kriventsova, G. A. (Inst. of Geochemistry and Analytical Chemistry, Moscow). Izv. Akad. Nauk SSSR, Ser. Khim.; No. 3, 708-710(Mar 1975). (In Russian).

Reversible transient changes of the absorption of uranyl complexes with the disodium salt of 1-(2-oxy-3,5-dinitrophenylazo)-2-oxynaphthaline-3,6-disulfonate were detected by pulse spectroscopy and explained as the cis-trans isomerization. The study of the ir absorption spectrum of the ligand and complex confirmed the assumption that the uranyl ion interacts only with one OH group of the coordination ligand which functions in this complex as a bidentate ligand. On the basis of the ir spectra and the data from the elementary analysis a structure was proposed for the complex studied. (tr-auth)

6058 SYNTHESIS OF D-XYLOSE LABELLED WITH TRITIUM IN POSITION 5 AND OF ITS DERIVATIVES 1,2,4-ORTHO-ACETYL-3-O-ACETYL-α-D-XYLOPYRANOSE-5-^3H AND 1,5-ANHYDRO-2-3-DI-O-ACETYL-β-D-XYLOFURANOSE-5-^3H. Bochkov, A. F.; Rodionov, A. V. (Inst. of Organic Chemistry, Moscow). Izv. Akad. Nauk SSSR, Ser. Khim.; No. 3, 667-670 (Mar 1975). (In Russian).

Beginning with 1,2-O-isopropyliden-α-d-xylo-pentodialdo-1,4-furanose and $NaBT_4$, d-xylose-5-T of high specific activity was synthesized and it was used for the synthesis of 1,2,4-orthoacetyl-3-O-acetyl-α-d-xylopyranose-5-T. 1,5-anhydro-2,3-di-O-acetyl-β-d-xylofuranose and its isotopic analog labelled with T in position 5 were synthesized and characterized. (tr-auth)

6059 INFRARED SPECTROSCOPY IN THE ANALYSIS OF ^{14}C-LABELLED AMINO ACIDS. Zilka, L. (Vyrobu a Vyuziti Radioisotopu, Prague). Radioisotopy.; 16: No. 2, 215-242(Apr 1975). (In Czech).

The spectral characteristics of biochemically important amino acids are given and a suitable microtechnical method for spectra measurement of radioactive samples and application examples are described. (auth)

6060 PEROVSKITES OF THE COMPOSITION $A_2BU^{IV}O_6$ WITH A, B = Ba, Sr, Ca, Mg, AND Pb. Kemmler-Sack, S.; Seemann, I. (Univ., Tuebingen, Ger.). Z. Anorg. Allg. Chem.; 411: No. 1, 61-78(Jan 1975). (In German).

The influence of the A and B ions on the charge transfer $O \rightarrow U$ are studied by diffuse reflectance measurements. They are completed by vibrational spectroscopic and structural investigations. (auth)

6061 ACTIVITY AND THERMAL STABILITY OF PRECIPITATED IRON CATALYSTS FOR AMMONIA SYNTHESIS, PROMOTED WITH URANIUM OXIDES. Badik, V. S.; Lyubchenko, Yu. A.; Sergeeva, A. N.; Dmitrenko, L. M. (Lvov Polytechnic Inst.). J. Appl. Chem. USSR (Engl. Transl.); 47: No. 10, 2239-2241(Oct 1974).

Translated from Zh. Prikl. Khim.; 47: No. 10, 2180-2183(Oct 1974).

Replacement of Al_2O_3 as a structural promoter in precipitated iron catalysts for ammonia synthesis by an equimolar amount

of U_3O_8, or by half of that amount, leads to simultaneous increase of activity and thermal stability. Replacement of Al_2O_3 by a threefold amount of U_3O_8 raises the thermal stability of the catalyst but lowers its activity. The activity of catalysts containing U_3O_8 is somewhat higher after prolonged heating at 550° than after brief heat treatment at the same temperature. (auth)

6062 TECHNETIUM-99m-HUMAN FIBRINOGEN. Wong, D. W.; Mishkin, F. S. (Martin Luther King, Jr. General Hospital, Los Angeles). J. Nucl. Med.; 16: No. 5, 343-347(May 1975).

Exogenous fibrinogen has been successfully labeled with /sup 99m/Tc using a modified electrolytic method. The exact labeling mechanism has not been determined. Experimental data suggest that the labeling process of /sup 99m/Tc-fibrinogen is quite similar to that of /sup 99m/Tc-human serum albumin as reported earlier by Benjamin. Technetium-99m-fibrinogen is stable in human plasma or in 1 percent buffered human serum albumin. A binding efficiency of 76 percent has been achieved with approximately 25 percent clottable protein. The entire labeling procedure requires less than 1 hr of preparation time. This short labeling time in a closed system may allow development of a practical method for labeling autologous fibrinogen, thus eliminating the risk of hepatitis transmission. (auth)

6063 THEORY OF THE DISSOCIATION OF A TWO-ATOM MOLECULE UNDER THE EFFECT OF THE RECOIL MOMENTUM OF A GAMMA QUANTUM. Braun, P. A.; Veselov, M. G.; Rebane, T. K. (Leningrad State Univ.). Teor. Eksp. Khim.; 11: No. 1, 10-15(1975). (In Russian).

A simple quantum-chemical theory is proposed in calculating the dissociation probability of a two-atom molecule under the effect of the recoil momentum of a gamma quantum. The main feature of the theory is that after emission of a gamma quantum the state of the molecule is a superposition of states having various values of internal energy. Therefore the molecule can dissociate even in those cases where the recoil energy transmitted to internal degrees of freedom is insufficient for dissociation from the viewpoint of classical mechanics, and conversely the molecule may be retained in a bound state when the energy obviously exceeds the dissociation energy. A formula is obtained for the energy distribution of the final states of the molecule that make it possible to calculate the probability of dissociation and of retention for two-atom molecules. The simplest measure of the "smearing" of the final state energies of a molecule, the average square energy deviation ΔE, is expressed by the frequency of the zero oscillations of the molecule. Values of ΔE are calculated for molecules of the halogen acids and the halogen deuterides. (7 refs.) (tr-auth)

6064 REACTION OF URANIUM TRICHLORIDE WITH ALKALI EARTH METAL CHLORIDES. Desyatnik, V. N.; Dubinin, B. V.; Mel'nikov, Yu. T.; Raspopin, S. P. Zh. Neorg. Khim.; 20: No. 4, 1085-1087(Apr 1975). (In Russian).

Phase diagrams of the binary system $MeCl_2-UCl_3$ (Me = Mg, Ca, Sr, or Ba) were studied by differential thermal analysis. It was shown that when uranium trichloride reacts with magnesium chloride, a simple eutectic system is formed. With calcium chloride, uranium trichloride forms a simple eutectic system with solid solution areas based on both calcium chloride and uranium trichloride. Strontium chloride and barium chloride with uranium trichloride form simple eutectic systems with the unstable chemical compounds $SrCl_2.UCl_3$ and $2BaCl_2.UCl_3$. (tr-auth)

6065 DOUBLE MOLYBDATES OF RUBIDIUM AND THORIUM. Bushuev, N. N.; Trunov, V. K. (Moscow State Univ.). Zh. Neorg. Khim.; 20: No. 4, 1143-1144(Apr 1975). (In Russian).

X-ray phase and thermographic analyses were made of the $Rb_2MoO_4-Th(MoO_4)_2$ system. Elementary cell parameters were determined for the compounds obtained. (tr-auth)

6066 REDUCTION OF PERRHENATE AND PERTECHNETATE IONS BY HYDROCHLORIC ACID. Borisova, L. V.; Ermakov, A. N.; Prasolova, O. D. (Inst. of Geochemistry and Analytical Chemistry, Moscow). Dokl. Chem. (Engl. Transl.); 218: No. 1-3, 653-655(Sep 1974).

Translated from Dokl. Akad. Nauk SSSR; 218: No. 3, 581-584 (Sep 1974).

Use of concentrated sulfuric acid permits reduction of heptavalent rhenium to hexavalent by means of concentrated hydrochloric acid. Technetium under the same conditions is reduced to an oxidation state of about three. (LK)

6067 PREPARATION AND RADIO GASCHROMATOGRAPHIC IDENTIFICATION OF ORTHO-, META-, PARA-ASTATOCHLORO-, ASTATOBROMO-, AND ASTATOIODOBENZENE ISOMERS. Meyer, G. J.; Roessler, K.; Stoecklin, G. (Kernforschungsanlage, Juelich, Ger.). Radiochem. Radioanal. Lett.; 21: No. 3-4, 247-259(10 May 1975).

o-, m-, p-astatochloro-, astatobromo- and astatoiodo-benzene isomers were prepared via decomposition of the corresponding o-, m-, p-halobenzene diazonium salts in the presence of ^{211}At (T = 7.2 h), analogous to the Sandmeyer reaction. A mild and rapid separation and identification of the isomers was achieved by radio gaschromatography at 125°C using a bentone and silicon oil loaded chromosorb column. The astato-halobenzene isomers were identified via comparison of the retention times with those of the homologous dihalobenzenes. Similarly, the boiling points of the astatochloro-, astatobromo- and astatoiodobenzenes have been determined via extrapolation and are 276 ± 4°C, 304 ± 4°C, and 337 ± 5°C, respectively. (auth)

6068 CYANIDE COMPLEXES OF HEXAVALENT AND PENTAVALENT URANIUM IN AQUEOUS SOLUTIONS. Musikas, C.; Marteau, M.; Cuillerdier, C. (CEA, Fontenay aux Roses, France). Radiochem. Radioanal. Lett.; 21: No. 3-4, 193-203 (10 May 1975).

The cyanic complexes of U(VI) and U(V) were studied by spectrophotometric and electrochemical methods. U(VI) ions give cyanic complexes with stability comparable to the fluoride complexes, but the basicity of CN^- ions allow their observance only in a narrow pH range. (auth)

6069 BEHAVIOR OF PENTAVALENT TECHNETIUM IN THE SYSTEM: (H^+, Li^+, Cl^-, ClO_4^-) (μ = 6) CHLOROFORM, 5,7-DICHLORO-8-HYDROXYQUIANOLINE. Mikulaj, V.; Guillaumont, R. (Paris Univ., Orsay, France). Radiochem. Radioanal. Lett.; 21: No. 3-4, 137-150(10 May 1975).

Stable solutions of Tc(V) may be obtained in trace concentration and they are extractable with 5,7-dichloro-8-hydroxyquinoline according to a simple mechanism. A polymerisation of chelate in organic phase at higher concentrations of Tc(V) increasing a distribution ratio, is to some extent surprising. In 6M HCl saturated with 10^{-3} to 10^{-4}M chloroxine in chloroform the $^{99m}Tc(V)$ exists as a cation of charge 1^+ but the extraction method does not allow to distinguish between TcO_2^+, $TcO_2(H^+Ox^-)_2^+$ and $(TcOOHOxH^+Ox^-)^+$ species. (auth)

6070 NMR SPECTRUM OF ACETONE ORIENTED IN AN INORGANIC MESOPHASE. Shcherbakov, V. A.; Shcherbakova, L. L.; Semakov, B. V. J. Struct. Chem. (USSR) (Engl. Transl.); 15: No. 5, 815-816(1974).

Translated from Zh. Strukt. Khim.; 15: No. 5, 925-927(1974).

Orientation of acetone molecules was observed when acetone was added to a concentrated solution of uranyl fluoride that was first slightly heated, frozen, and then melted. The NMR spectrum obtained is given. The scale of the multiplet of the orientated acetone increases below 0°C, but the spectrum is maintained to −25°C. The multiplet is not affected by magnetic field intensity nor by pumping at resonance frequencies of the water protons and the ^{19}F of uranyl fluoride. The phenomenon is completely reproduced in solutions of heavy water. The NMR spectrum was calculated and compared with experimental value. (JSR)

6071 STRUCTURE OF $Cs_2[(UO_2)_2F_8(H_2O)_2]$ CRYSTALS. Mikhailov, Yu. N.; Ivanov, S. B.; Udovenko, A. A.; Davidovich, R. L.; Kuznetsov, V. G.; Peshkov, V. V. (Inst. of General and Inorganic Chemistry, Moscow). J. Struct. Chem. (USSR) (Engl. Transl.); 15: No. 5, 838-839(1974).

Translated from Zh. Strukt. Khim.; 15: No. 5, 943(1974).

The crystal parameters were measured. The coordinates of the U and Cs atoms were made on the basis of two-dimensional and electron-density syntheses and refined by the method of least squares. The atomic coordinates are tabulated. The structure has an island character and the water molecules enter directly into the coordination sphere of the U(VI) atom. (JSR)

6072 RADIOACTIVE KRYPTONATES OF ORGANOSULFUR COMPOUNDS. IX. Thermal and Dekryptonation Study of 4-Ethoxyphenylisothiocyanate. Uher, M.; Harangozo, M.; Kosik, M.; Tolgyessy, J. (Slovak Technical Univ., Bratislava). Radiochem. Radioanal. Lett.; 21: No. 5, 335-338(24 May 1975).

The synthesis of radioactive kryptonate of 4-ethoxyphenylisothiocyanate by a diffusion technique and the thermal (DTA, TG, DTG, thermofractography) and dekryptonation thermal studies of this kryptonate are described. (auth)

6073 ELECTROCHEMILUMINESCENCE OF URANYL SOLUTIONS IN PERCHLORIC ACID. Bulgakov, R. G.; Kazakov, V. P.; Parshin, G. S.; Sharipov, G. L. (Inst. of Chemistry, Ufa, USSR). Bull. Acad. Sci. USSR, Div. Chem. Sci.; 23: No. 8, 1846(Aug 1974).

Translated from Izn. Akad. Nauk SSR, Ser. Khim.; 23: No. 8, 1916-1917(Aug 1974).

The electrochemiluminescence (ECL) of solutions of UO_2^{2+} in 8.5 M $HClO_4$ solution was studied. It is postulated that the ECL is caused by the reaction of the cathode reduction products of $HClO_4$ with the UO_2^{2+} ions. (LK)

6074 SUPERHEAVY ELEMENTS. Hermann, G. (Univ., Mainz). pp 221-272 of Radiochemistry. Maddock, A. G. (ed.). London; Butterworths (1975).

The subject is reviewed in chapters, entitled: properties of superheavy nuclei (location of nucleon shells, fission barriers, lifetime estimates, prediction of other fission properties); electronic configuration and chemical properties of superheavy elements; search for superheavy elements in nature; methods for the synthesis of superheavy elements. (UK)

6075 PRECISION OF THE DETERMINATION OF WEIGHT DISTRIBUTION COEFFICIENT BY THE RADIOTRACER BATCH EQUILIBRATION METHOD. de Corte, F.; van Acker, P.; Hoste, J. (Ghent Rijkuniversiteit). Anal. Chim. Acta; 75: No. 1, 246-249(Mar 1975).

In ion exchange, the weight distribution coefficient K_d is defined as the ratio of the amount of the element per gram of dry resin to the amount of the element per ml of solution. A series of equations was developed that not only allows calculation of the precision on the experimentally determined K_d values, but also enables the optimal working conditions to be selected. (JGB)

6076 POTENTIAL/pO^{2-} DIAGRAM OF PLUTONIUM IN A MIXTURE OF LiCl–CsCl (55-45% mol) AT 450°. Landresse, G. (Fonds National de la Recherche Scientifique, Brussels); Duyckaerts, G. Anal. Chim. Acta; 75: No. 1, 242-245(Mar 1975). (In French).

The various equilibria of Pu^{4+} and PuO_2^+ occurring in a LiCl–CsCl mixture at 450°C were studied quantitatively by visible and near ir absorption spectroscopy. The equilibrium constants were measured and the normal potentials of the various species occurring in the mixture were calculated. A potential/pO^{2-} diagram was constructed on the basis of these data for concentration of the various species of 10^{-2}M. The conditions for obtaining different couples in the mixture were evaluated. The distribution of PuO_2(V) and PuO_2(VI) was determined as a function of the logarithm of the partial Cl_2 pressure. (JSR)

6077 METHOD FOR QUANTITATIVE DETERMINATION OF A SMALL DIFFERENCE BETWEEN DIFFUSION COEFFICIENTS. Miller, L. (National Chemical Research Lab., Pretoria). J. Phys. Chem.; 79: No. 12, 1218-1221(5 Jun 1975).

Small differences between diffusion coefficients are determined by separative diffusion in the transient state. The method compares experimental results for cylindrical diffusion with computer results. As an example the isotope effect in the diffusion of uranyl nitrate in agar gel was investigated. (auth)

6078 TECHNETIUM-99m LABELING BY MEANS OF STANNOUS PYROPHOSPHATE: APPLICATION TO BLEOMYCIN AND RED BLOOD CELLS. Bardy, A.; Fouye, H.; Gobin, R.; Beydon, J.; de Tovar, G.; Panneciere, C.; Hegesippe, M. (CEN de Saclay, Gif-sur-Yvette, France). J. Nucl. Med.; 16: No. 5, 435-437(May 1975).

A new technique of technetium labeling using stannous pyrophosphate instead of stannous chloride as reducing agent for pertechnetate has been applied to red blood cells and bleomycin. Results are so encouraging that this technique could be extended to other compounds capable of forming stable complexes with reduced technetium. No saline washes of red cells are necessary before or after the addition of pertechnetate. No purification step is performed after labeling of bleomycin. (auth)

6079 AUTOLOGOUS RADIOIODINATED FIBRINOGEN, SIMPLIFIED. Frisbie, J. H.; O'Connell, D. J.; Tow, D. E.; Sasahara, A. A.; Belko, J. S. (Veterans Administration Hospital, West Roxbury, MA). J. Nucl. Med.; 16: No. 5, 393-401(May 1975).

A method for the rapid preparation of radioiodinated autologous fibrinogen has been improved. Plasma is separated from cells by a single centrifugation. Fibrinogen is isolated in two salting-out steps at a 1:4 dilution of plasma and 22.5 percent saturated ammonium sulfate. Iodination is accomplished with chloramine T at a chloramine T-to-fibrinogen molar ratio of 12:1. Free iodide is removed by a single dilution and salting-out step at 29 percent saturated ammonium sulfate. Preparation time is about 1 hr; clottable radioactivity is 90 to 95 percent. Denaturation due to storage is undetectable at 6 weeks. Advantages of this procedure are (a) a short preparation time and (b) a purified autologous radioiodinated fibrinogen preparation. (auth)

Radioactive Waste Treatment

Refer also to abstracts 6044 and 8418.

6080 (AI-ERDA-13151) DISPOSAL OF TRANSURANIC SOLID WASTE USING ATOMICS INTERNATIONAL MOLTEN SALT COMBUSTION PROCESS. McKenzie, D. E.; Grantham, L. F.; Paulson, R. B.; Richards, W. L.; Rennick, R. B. (Atomics International Div., Canoga Park, Calif. (USA)). 5 May 1975. Contract AT(04-3)-701. 68p. Dep. NTIS $5.45.

The Atomics International Molten Salt Combustion Process for disposal of transuranic solid waste utilizes a molten salt to combust organic materials, to trap inorganic substances including transuranics, and to react chemically with acidic gases formed during combustion. Subsequent processing of the melt in an aqueous system produces three products: (1) ash, which includes the transuranics, (2) salt, which is recycled to the combustor, and (3) solid sodium chloride for disposal. The transuranics are readily leached from the ash and separated via ion exchange techniques. The leached ash is the second solid process product requiring disposal. No liquid wastes are produced in the process. The reductions in weight and volume are 82 and 98 percent respectively, if one considers the products from the process only. (auth)

6081 (ARH-2059) THERMALT PROCESS FOR IMMOBILIZATION OF RADIOACTIVE WASTES. Brownell, L. E.; Isaacson, R. E.; Kupfer, M. J.; Schulz, W. W. (Atlantic Richfield Hanford Co., Richland, Wash. (USA)). 15 Apr 1971. 21p. Dep. NTIS $4.25.

The Thermalt process involves an exothermic, thermite-like reaction of aluminum metal with basalt, quartz sand, and radioactive waste. The resulting melt when solidified is a silicious stone-like material that is similar in chemical composition to basalt. The process utilizes low cost ingredients: basalt rock, which occurs naturally in the Hanford region, inexpensive aluminum metal such as aluminum scrap which need not be pure, and the waste which is predominately sodium nitrate salt. The waste itself along with the basalt provides the oxygen necessary for the reaction. The exothermic reaction provides the necessary heat to melt the ingredients thus eliminating the need for external heat sources such as furnaces which are necessary with most other melt methods. The final product is highly stable and essentially nonleachable; leach rates appear as low or lower than other melt products described in the literature. Initial studies indicate the process is effective for both low-level and high-level wastes. (auth)

6082 (ARH-SA-204) (PLUTONIUM CRITICALITY CONSIDERATIONS IN REPROCESSING WASTES AND CONTAMINATED SOILS. Carter, R. D. (Atlantic Richfield Hanford Co., Richland, Wash. (USA)). Mar 1975. Contract AT(45-1)-2130. 17p. (CONF-750411-4). Dep. NTIS $4.00.

From European nuclear conference; Paris, France (21 Apr 1975).

An intensive study was made of the effects of Pu density, added scatterers, and hydrogen-to-plutonium (H/Pu) ratios on critical dimensions and masses in order to evaluate the possibility of the development of Pu critical systems in soils to which Pu waste solutions had been released. The results were applied to a safety analysis of the Z-9 trench at Hanford where large quantities of waste solution were discarded prior to 1962. The calculations were expanded to a general parameter study and to a study of the effects of a Cd addition. Critical mass curves were determined. Several areas where these calculations might have practical applicability, as in spillage of Pu solutions into the soil or in transporting Pu, were discussed. (JSR)

6083 (ARH-SA-210) GLASS FORMS FOR IMMOBILIZATION OF HANFORD WASTES. Schulz, W. W.; Dressen, A. L.; Hobbick, C. W.; Babad, H. (Atlantic Richfield Hanford Co., Richland, Wash. (USA)). Mar 1975. 31p. (CONF-750535-4). Dep. NTIS $4.75.

From meeting of the American Ceramic Society; Washington, District of Columbia, USA (7 May 1975).

Approximately 140 million liters of solid salt cake (mainly $NaNO_3$), produced by evaporation of aged, alkaline high-level liquid wastes, will be stored in underground tanks when the present Hanford Waste Management Program is completed in the early 1980's. At this time also, large volumes of various other solid radioactive wastes (sludges, excavated Pu-contaminated soil, and doubly encapsulated $^{137}CsCl$ and $^{90}SrF_2$) will be stored on the Hanford Reservation. All these solid wastes can be converted to immobile silicate and aluminosilicate glasses of low water leachability by melting them at 1100° to 1400°C with appropriate amounts of basalt (or sand) and other glass-formers such as B_2O_3 or CaO. Reviewed in this paper are formulations and other melt conditions used successfully in batch tests to make glasses from actual and synthetic wastes; leachability and other properties of these glasses show them to be satisfactory vehicles for immobilization of the Hanford wastes. (auth)

6084 (ARH-ST-118A) ATLANTIC RICHFIELD HANFORD COMPANY SEMIANNUAL REPORT, BB PROCESS DEVELOPMENT, NOVEMBER 1, 1973 THROUGH APRIL 30, 1974. Fox,

R. D. (Ed.). (Atlantic Richfield Hanford Co., Richland, Wash. (USA)). Mar 1975. Contract AT(45-1)-2130. 68p. Dep. NTIS $4.25.

Dissolution experiments on PuO_2 at 100^0 were continued using solvents (HNO_3–HF) with compositions similar to those of plant dissolver solution. A new and improved HNO_3–HF leaching process for removing plutonium from Z-9 trench soil was devised and tested. Molten salt fusion tests indicated that the amount of salt required to recover plutonium from incinerator ash was dependent on incinerator feed and operating conditions. A hydroxylamine nitrate scrubbing solution removed 99 percent of the NO_2 from the process off-gas stream. Mixer-settler tests show that workable Pu(IV) extraction flowsheets which employ radiolysis-resistant tributyl phosphate (TBP)–trichlorobenzene (TCB) solvents can be devised. Flowsheet tests with 20 percent TBP–TCB solvents were completed. Studies indicated that a conceptual reflux amine plutonium recovery process is significantly improved by operation at 50^0C rather than at 25^0C. Kinetics of plutonium extraction and stripping by Amberlite LA-2 (trade name, Rohm and Haas Company) solvents were measured at 25^0 and 50^0C. In studies on disposal of waste organic solvent, commercial surfactants capable of producing stable emulsions of TBP–CCl_4 solvent in high salt aqueous waste solutions were found. In studies on the anion exchange recovery of plutonium from contaminated soil, the capacity of weak and strong base resins for sorbing plutonium from Z-9 trench soil leach liquor was determined. Progress in studies on the concentration of nonboiling wastes, solidification of wastes with phosphoric acid, and solidification by the aqueous silicate process is reported. In studies on the characterization of waste tank salt cake, methods for determining the physical properties of salt cake were developed. Leachability of ^{90}Sr from contaminated BC Crib soil was determined using various aqueous leaching agents. A central data reduction system capable of meeting all requirements for radionuclide inventory and assay was designed. Equipment for monitoring surficial contamination was laboratory-tested. In waste characterization studies, nondestructive testing and laboratory assay helped to characterize such areas as the BC Crib and U Pond. A status review was done on the BC Crib, over 500 environmental determinations were made on the U Pond, and initial chemical and physical property studies were undertaken in both areas. First detonation experiments were carried out on potentially hazardous substances in the salt cake. A toxicity study was made of all the elements. Initial outside-the-tank leak detection tests were conducted using two concepts, conductivity and impedance measurements, and results were satisfactory in an idealized test site. Automatic air sampling equipment was installed at U Area and BC Area. An engineering audit of the present liquid level measurement system and data transmission system was completed and documented. Two liquid level measurement systems, one based on radiofrequency and the other on ultrasonic frequency, were evaluated in the laboratory as potential alternatives to the existing liquid level measurement system. Test results indicate that localized concentration cells should not be a cause of premature failure of waste tank liners. The effectiveness of nitrite in reducing the rate of attack on carbon steel was found to be both concentration- and temperature-dependent. The minimum current density to cathodically protect mild-steel specimens lies between 5 and 10 milliamperes per square foot. An ultrasonic needle probe was developed that can locate cracks which fully penetrate waste tank walls. (JGB)

6085 (BNL-19688) TRITIUM STORAGE DEVELOPMENT. Progress Report No. 2, October–December 1974. (Brookhaven National Lab., Upton, N. Y. (USA)). Jan 1975. 30p. Dep. NTIS $4.50.

Work is reported on the development of tritium fixation in cement concrete, polymer-impregnated concrete, and conversion to highly stable organic compounds. The scope of the work is to develop formulations and to evaluate the chemically and physically stable solid forms for long term storage. The selection of hydraulic cement was based on its ability to react with water, its noncorrosive nature, its ability to be formed into any shape at normal temperature and its ability to withstand heat and flame. Another important factor is availability in all parts of the country at reasonable prices. The techniques developed at Brookhaven National Laboratory for impregnating hardened concrete with polymer will be applied to this work to further enhance the integrity and watertightness of tritiated concrete. The fixation of tritium in highly stable polymeric materials has an advantage in that the carbon-hydrogen bonds are highly covalent. This should result in a very low hydrogen exchange rate. An approach to the preparation of a tritiated polymeric material is the production of acetylene through the reaction of tritiated water and calcium carbide. The acetylene is then converted to a stable solid tritiated polyacetylene. The fixation methods described above are currently being studied and further described in the text. (auth)

6086 (BNWL-B-406) SUMMARY REPORT ON MICROSTRUCTURE AND COMPOSITION OF SILICATE MELTS CONTAINING SIMULATED HANFORD WASTE. Daniel, J. L. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Apr 1975. (Contract AT(45-1)-1830. 51p. Dep. NTIS $5.45.

Specimens of silicate melt glasses containing simulated Hanford waste were studied by microscopy and microprobe methods to determine microstructural and compositional characteristics. The two glass specimens were representative of glasses prepared with Hanford basalt and with sea sand as the source of SiO_2. Samples of both glasses were studied in detail at locations near the top, bottom, center, and sides of the melts. Both glasses were of a highly uniform microstructure and composition. The basalt glass contained metallic iron inclusions around the periphery near the glass/crucible interface, and small increases in Si content adjacent to the pores occurring throughout the glass. The sand glass contained no iron, its Si composition was uniform, and the average pore size was somewhat smaller (about 2 mu m) than in the basalt glass. The Ca nominally added to the sand glass could not be detected. Both glasses contained a random scattering of a micron-sized "bright" phase whose composition was identical to the matrix or containing elements not detectable by microprobe methods. (auth)

6087 (CEA-CONF–2740) FISSION PRODUCT VITRIFICATION. Fabrication of Glasses and Storage. Bonniaud, R. (CEA Centre de Marcoule, 30 - Bagnols-sur-Ceze (France). Dept. de Genie Radioactif). 1974. 8p. (In French). INIS.

From French-Spanish colloquium; Marcoule; Fontenay-aux-Roses, France (25 Apr 1974).

Information on the vitrification of fission products is reviewed, and the problems still to be clarified in the following areas are examined: composition, stability, and effects of radiation on glasses; fabrication of glass; storage of the glasses and air ventilation or water cooling. The known facts are considered to be sufficient to consider the construction of industrial installations. (FR)

6088 (CEA-CONF–2899) MANAGEMENT OF PLUTONIUM-CONTAMINATED SOLID WASTES AT THE CADARACHE CENTRE. Mery, J.; Marcaillou, J. (CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-les-Durance (France)). 1974. 16p. (In French). INIS.

From seminar on management of plutonium-contamined solid wastes; Marcoule, France (14 Oct 1974).

The procedure used for each type of waste collected in the plutonium fuel manufacturing plants is described, taking into account the following aims: reduction of volumes at the production stage and estimation of the quantities of Pu contained in the wastes; reduction of volumes for storage, by compacting and improvement of the characteristics of embedded products; optimization and modification of the incinerator for the treatment of Pu-contaminated wastes. (FR)

6089 (CONF-750535-1) LEACH BEHAVIOR OF CEMENTITIOUS GROUTS INCORPORATING RADIOACTIVE WASTES. Godbee, H. W.; Moore, J. G.; Kibbey, A. H.; Joy, D. S. (Oak Ridge National Lab., Tenn. (USA)). 1975. 42p. Dep. NTIS $5.25.

From meeting of the American Ceramic Society; Washington, District of Columbia, USA (7 May 1975).

Grouts similar to those used in the Hydrofracture Facility at Oak Ridge National Laboratory (ORNL) were made by blending simulated intermediate-level waste solution containing ^{85}Sr, ^{137}Cs, ^{239}Pu, or ^{244}Cm with a dry mixture of cementitious materials and selected clays, and the products tested for retention of these isotopes in International Atomic Energy Agency (IAEA)-type leach tests. The fraction of isotope leached varied with the square root of time if leachant replacement was more frequent than once per day, but was inhibited or depressed if changed less often. When Grundite clay (for cesium retention) was present, the isotope leach rates followed the order: Cs greater than Sr greater than Cm greater than Pu, with overall results indicating that grouts can give leach rates comparable to those obtained for wastes incorporated into borosilicate glasses. Curing a grout specimen up to 28 days in humid air before leaching decreased the amount leached from the specimen. The leach rate for cesium was decreased by the addition of Grundite, pottery clay, or Conasauga shale. These additives, as listed, are in the order of increasing effectiveness with respect to cesium retention. Theoretical relationships that consider diffusion and instantaneous reaction (an equilibrium or time-independent relationship between mobile and immobile forms of a species) give good agreement with the data for the 28-day-cured grouts when the leachant was initially replaced twice per day. Using the derived modified effective diffusivities, D/sub e/'s, comparisons were made of the amounts leached from a 55-gal drum of grout assuming two dif-

ferent forms for the drum, a semi-infinite medium and a finite cylinder. These calculations show that the drum approximates a semi-infinite medium for a few years if the D/sub e/ is approximately 1 x 10^{-9} cm^2/sec and for more than 3000 years if the D/sub e/ is approximately 6 x 10^{-10} cm^2/sec. They also show that the projected amounts leached from a waste product which is assumed to approximate a semi-infinite medium are conservative (on the side of safety) since they are equal to or greater than the amounts predicted by a solution based on the actual geometry of the finite product. (auth)

6090 (COO-2510-4) CERAMIC NUCLEAR WASTE FORMS. II. A Ceramic-Waste Composite Prepared by Hot Pressing. Progress Report and Preprint. McCarthy, G. J. (Pennsylvania State Univ., University Park (USA). Materials Research Labs.). 23 Apr 1975. Contract AT(11-1)-2510. 28p. (CONF-750535-3). Dep. NTIS $4.50.

From meeting of the American Ceramic Society; Washington, District of Columbia, USA (7 May 1975).

A feasibility study was conducted to determine whether nuclear waste calcine and a crystalline ceramic matrix can be fabricated by hot pressing into a composite waste form with suitable leaching resistance and thermal stability. It was found that a hard, dense composite could be formed using the typical commercial waste formulation PW-4b and a matrix of alpha-quartz with a small amount of a lead borosilicate glass added as a consolidation aide. Its density, waste loading, and leaching resistance are comparable to the glasses currently being considered for fixation of nuclear wastes. The hot pressed composite offers a closer approach to thermodynamic stability and improved thermal stability (in monolithic form) compared to glass waste forms. Recommendations for further optimization of the hot pressed waste form are given. (auth)

6091 (DP-MS-74-69) INCORPORATION OF SAVANNAH RIVER PLANT RADIOACTIVE WASTE INTO CONCRETE. Stone, J. A. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.). 1975. Contract AT(07-2)-1. 18p. (CONF-750535-5). Dep. NTIS $4.00.

From meeting of the American Ceramic Society; Washington, District of Columbia, USA (7 May 1975).

Results are reported of a laboratory-scale experimental program at the Savannah River Laboratory to gain information on the fixation of high-level radioactive wastes in concrete. Two concrete formulations, a High-Alumina Cement and a Portland Pozzalanic cement, were selected on the bases of leachability and compressive strength for the fixation of non-radioactive simulated wastes. Therefore, these two cements were selected for current studies for the fixation of actual Savannah River Plant high-level wastes. (auth)

6092 (DP-MS-74-70) INCORPORATION OF SAVANNAH RIVER PLANT RADIOACTIVE WASTE INTO GLASS. Kelley, J. A. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.). 1975. Contract AT(07-2)-1. 19p. (CONF-750535-2). Dep. NTIS $4.00.

From meeting of the American Ceramic Society; Washington, District of Columbia, USA (7 May 1975).

Simulated and actual radioactive wastes were incorporated into borosilicate glass at the Savannah River Plant in laboratory-scale tests. Bulk leachabilities for both ^{137}Cs and ^{90}Sr are 10^{-6} to 10^{-5} g/(cm^2-day) initially and 10^{-7} g/(cm^2-day) after 4 weeks. Cesium volatility during glass melting at 1150°C is 0.3 percent. Ruthenium volatility is 10 to 50 percent because of nitrate and MnO_2 in simulated waste. With actual waste, which contains low concentrations of nitrate and MnO_2, ruthenium volatility is less than 3 percent. (auth)

6093 (JAERI-M-5846) THE CHEMICAL FORM OF FISSION IODINE RELEASED FROM SLIGHTLY IRRADIATED UO_2 POWDER AND UO_2-GRAPHITE POWDER MIXTURE AT ELEVATED TEMPERATURES. Fukuda, T.; Handa, M.; Shiba, K. (Japan Atomic Energy Research Inst., Tokyo). Sep 1974. 10p. (In Japanese). INIS.

Fission iodine, reportedly, is released as UI_4 at high temperatures to the inert gas atmosphere from slightly irradiated UO_2 powder or the similarly irradiated mixture with graphite powder. This reasoning stems from the fact that the deposition temperature of fission iodine in the thermochromatograph, differs from that of elementary iodine, but it agrees with that of UI_4. The quantities of elementary iodine and UI_4 used in this case, however, are several orders of magnitude higher than those of the fission iodine. It was found that the deposition temperature of elementary iodine changes largely with the quantity used in the experiment; the temperature is higher for a smaller quantity possibly due to the chemi-sorption. Comparing the deposition temperature between elementary iodine and fission iodine, each of the same quantity, the fission iodine released is found to be as atomic rather than UI_4. (auth)

6094 (JAERI-M-5847) CAPTURE OF FISSION IODINE RELEASED FROM UO_2-GRAPHITE MIXTURE WITH VARIOUS CERAMIC MATERIALS. Fukuda, T.; Shiba, K.; Handa, M. (Japan Atomic Energy Research Inst., Tokyo). Sep 1974. 13p. (In Japanese). INIS.

In connection with the development of internal traps of a gas cooled reactor, the iodine trapping capability was studied on 13 kinds of ceramic material with a thermochromatograph, which consists of the deposition tube with a temperature gradient. In the experiments, purified helium gas was used as the carrier gas for fission iodine (^{131}I) released at high temperature from the slightly irradiated mixture of UO_2 and graphite powders. The deposition temperature of the fission iodine moves, depending not only on the ceramic material packed in the tube but also on the out-gassing conditions. Magnesium oxide, aluminum oxide, and calcium oxide, sufficiently out-gassed, are effective to collect the iodine at a temperature of about 1000°C. The fission iodine is possibly chemi-sorbed on the material. A convenient method is proposed of determining the heat of adsorption from time dependence of the deposition temperature. It is estimated to be over 50 kcal/mol for the three ceramic materials. (auth)

6095 USE AND ECONOMIC ADVANTAGES OF FLUID BED CALCINERS FOR VOLUME REDUCTION OF LIQUID RADWASTE. White, L. E.; Garcia, R. (Aerojet Energy Conversion Co., Sacramento, CA). Energ. Nucl. (Milan); 22: No. 4, 195-209(Apr 1975).

The Aerojet VR-20 Radioactive Waste Management System is described. This system offers the utility potential annual cost savings of several hundred thousand dollars over the conventional processes utilizing cement, cement/vermiculite or urea-formaldehyde solidification. Other benefits that accrue to the user include less waste storage space requirements, fewer packages of radioactive material to be handled, lower integrated dose of workers, and less likelihood of transportation accidents. In addition, application of this system to the nuclear power plant industry will result in an increased longevity of commercial burial sites and an overall reduction in the number of burial sites required to support the industry. (auth)

6096 FISSION PRODUCT VITRIFICATION FACILITIES IN WEST GERMANY. Com. Naz. Energ. Nucl., Not.; 21: No. 1, 70-74(Jan 1975). (In Italian).

A review of the activities conducted and the facilities in operation or planned for the disposal of highly radioactive wastes by vitrification is presented. (auth)

6097 INORGANIC SORBENTS FOR THE REMOVAL OF RADIOIODINE AND ITS ORGANIC COMPOUNDS AT NUCLEAR POWER PLANTS. Hladky, E.; Pietrik, I.; Moravek, J. Jad. Energ.; 21: No. 3, 91-96(Mar 1975). (In Czech).

Trapping of radioiodine and methyl iodide by $AgNO_3$ and KI-impregnated alumina and SiO_2 was studied. The radioiodine and methyl iodide removal efficiency was measured at various values of relative humidity, stay time, $AgNO_3$ and KI impregnation. Radioiodine desorption and rare gases sorption were also studied. The methyl iodide removal efficiency of $AgNO_3$-impregnated SiO_2 was observed to be slightly lower than the removal efficiency of impregnated alumina. Influence of sorbent aging on the removal efficiency of sorbents used was not observed. Mathematical equations for describing radioiodine and methyl iodide removal by the sorbents used are given in the report conclusions. (auth)

Radioisotope Production

Refer also to abstract 6884.

6098 (NIRS-R-2, pp 92-94) STUDY ON ^{43}K PRODUCTION BY CYCLOTRON. Ido, T.; Suzuki, K.; Nozaki, T.; Makiide, Y. Nov 1973. (In Japanese).

In first report on the cancer therapy with high energy particles and the utilization of short lived radionuclides in diagnostics. (National Inst. of Radiological Sciences, Chiba (Japan)).

A method for production of carrier-free ^{43}K for medical application was developed. The α beam accelerated by a cyclotron was reacted with an argon gas and ^{43}K, produced by the $^{40}Ar(\alpha,p)^{43}K$ reaction, was collected in the irradiation vessel, which was sterilized with heated vapor, washed and dried in a vacuum. The real contents of ^{43}K by this method were 10 μA, and the amount produced by 2-hour-irradiation was about 1 to 1.2 mCi. The coexistence of ^{42}K, which was accessarily produced was about 10% immediately after the irradiation, and no other nuclides were observed. When the alpha energy was increased to 24 to 26 MeV, not only ^{43}K but also accessory ^{42}K increased. The coexistence of the ^{42}K decreased the effect of collimaters in scinticamera and scintiscanner, and made measurements difficult. In the animal experiment, it was confirmed that ^{43}K solution obtained by this was sterile and non-pyrogenic. (JA)

6099 DEVICE TO INDICATE ELUTION STRENGTH OF ^{99m}Tc GENERATORS. Mitchell, R. G.; Chapman, K. (Northampton General Hospital, Eng.). Brit. J. Radiol.; 48: No. 567, 232-233(Mar 1975).

The device incorporates two moving systems driven by a mains-operated synchronous motor. One consists of a drum that rotates at a speed of 1 deg per hour and the other a threaded rod along which a pointer driven by means of a half-nut moves at ¾ in. per hour. The drum carries a chart of radial lines corresponding to absolute values of elution strength. (MC). The rotation of the drum accounts for the decay of the molybdenum parent while the movement of the pointer covers the build-up of the technetium. The pointer thus indicates the elution strength. A time-scale parallel to the rod enables prediction to be made of the elution strength after x hours. It is not intended that the device should replace measurement of the elute, but to give an indication of whether the generator is likely to be able to supply the demand at a particular time. The build-up covers a period of eight hours, after which the pointer runs off the threaded section of the rod and indicates the elution strength at infinity. After elution the pointer is returned to the zero mark on the scale. While the device was developed for ^{99m}Tc generators, the principle could be applied to other types, e.g., ^{113m}In. (auth)

6100 PRODUCTION OF ^{115m}In USING BIS(2-ETHYL HEXYL) PHOSPHORIC ACID (HDEHP). Haggag, A. (Atomic Energy Establishment, Cairo); El-Kot, A. J. Radioanal. Chem.; 25: No. 1, 29-33(1975).

A rapid method for the production of ^{115m}In from irradiated cadmium is described. The procedure of the method is based on the extraction of ^{115m}In by bis(2-ethyl hexyl)phosphoric acid (HDEHP) from 0.1N sulfuric acid. Accumulated ^{115m}In can then be reextracted into diluted hydrochloric, hydrobromic, nitric or sulfuric acid solutions with a concentration of 1N or higher. A summary on the behavior of cadmium and indium extraction with the solvent was given as a preliminary step in the present study. The produced ^{115m}In was found to be free from any cadmium as well as from any other foreign activity. (auth)

6101 MUTUAL EFFECT OF ELEMENTS IN THE SEPARATION BY SUBLIMATION OF THEIR CHLORIDES. Travnikov, S. S.; Davydov, A. V.; Myasoedov, B. F. (Inst. of Geochemistry and Analytical Chemistry, Moscow). J. Radioanal. Chem.; 25: No. 1, 17-27(1975).

The transfer and separation of the chlorides of a number of rare earth and actinide elements and their mixtures was investigated in the flow of gas-carrier along a quartz tube under temperature gradient. The dependence of the position (characteristic temperature) and shape of the condensation (or sorption) peak of cerium chloride in the gradient region of the tube on the amount of substance in the starting zone was studied. Weight limits determining the behavior of the substance as micro- or macrocomponent and its transfer by adsorption or condensation mechanism were established. The mutual effect of elements in the La–Ce, Am–U, Np–U systems has been studied. It is shown that in the case, when the condensation peak of the macrocomponent overlaps the adsorption zone of the microcomponent, the position of the adsorption peak is shifted and the effectiveness of the micro- and macrocomponent separation deteriorates in comparison with the separation of microamounts of elements. If the condensation of the macrocomponent occurs in temperature zones distant from that of the microcomponent adsorption, the position of the latter does not change and the degree of purification of the microcomponent increases. (auth)

Reactor Fuel Reprocessing

Refer also to abstracts 5841, 5937, 6425, and 8391.

6102 (CEA-CONF-2739) ADAPTATION OF THE PUREX PROCESS TO THE TREATMENT OF HIGHLY IRRADIATED OXIDES FROM ELECTRO-NUCLEAR REACTORS. Miquel, P. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Genie Radioactif). 1974. 16p. (In French). INIS.

From French-Spanish colloquium; Marcoule; Fontenay-aux-Roses, France (25 Apr 1974).

In order for the Purex process to be used for reprocessing the reactor oxides, it must be adapted to the conditions imposed by the irradiation and high fuel enrichment. The various stages of the treatment are described: dismantling the assemblies and cutting up the fuel pins; dissolving the irradiated oxides and clarifying the solutions; purifying and separating the uranium and plutonium, and processing the wastes. (FR)

6103 (ICP-1062) BREAKING SILICON CARBIDE COATINGS ON FT. ST. VRAIN FERTILE PARTICLES USING A GAS JET. Interim Experimental Results. Palmer, W. B. (Allied Chemical Corp., Idaho Falls, Idaho (USA). Idaho Chemical Programs–Operations Office). Mar 1975. Contract AT(10-1)-1375. 14p. Dep. NTIS $4.00.

Pilot-plant testing of gas jets for breaking the silicon carbide coatings on unirradiated Ft. St. Vrain fertile particles is described. The results showed that fluid-bed jet breaking is an effective method. (JSR)

6104 (ICP-1070) EXPERIMENTAL TESTING OF THE DOUBLE-ROLL CRUSHER FOR BREAKING SILICON CARBIDE COATINGS ON UNIRRADIATED FT. ST. VRAIN FUEL PARTICLES. Palmer, W. B. (Allied Chemical Corp., Idaho Falls, Idaho (USA). Idaho Chemical Programs–Operations Office). Apr 1975. Contract AT(10-1)-1375. 16p. Dep. NTIS $4.00.

Testing of a 4-inch diameter double-roll crusher for crushing Ft. St. Vrain TRISO particles has been completed. The effect of feed rate, roll speed, roll clearance, and carbon particle interference on crushing efficiency and crushed particle size distribution was determined. Wear rates of the rolls were not determined. (auth)

6105 (JAERI-M-5878) CHLORINATION-DISTILLATION PROCESSING OF IRRADIATED URANIUM DIOXIDE FUEL. Hirano, K. (Japan Atomic Energy Research Inst., Tokyo). Oct 1974. 124p. (In Japanese). INIS.

Research on the decontamination of fission products from irradiated uranium dioxide was performed by means of chlorination-distillation using carbon tetrachloride vapor as the chlorinating agent. The research is composed of four steps. The first step is the preliminary experiment with unirradiated synthetic samples. The second step contains experiments on the chlorination-distillation of irradiated samples, the decontamination of radiocerium by addition of natural cerium dioxide powder, the improvement of the uranium recovery by sodium chloride sorption, and the increase of the decontamination by repeating the chlorination-distillation. The third step contributes the main part of the present work, and contains the experiment on the decontamination of fission products from irradiated samples by means of the sorption-desorption with a barium chloride bed. In this process, γ-emitting nuclides except cesium are nearly all removed from the uranium, and the γ-activity of uranium just after separation decreases to less than natural uranium. The fourth step contains the experiment on the decontamination of cesium by means of a hydrochlorination using hydrogen chloride gas. (auth)

6106 (KFK-2082) ELECTROLYTIC METHODS IN THE PUREX-PROCESS. Schmieder, H.; Baumgaertner, F.; Goldacker, H.; Hausberger, H. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Heisse Chemie). Dec 1974. 103p. (In German). INIS.

31 figs.; 7 tabs.; 42 refs.

A 16-stage electrolytic mixer-settler, operating without diaphragms, was constructed on the basis of investigations on corrosion rates and electrolytic mass transfer at different electrode materials. The mixer-settler casing was made of titanium. The Pu-U separation (1B-Battery) and the Pu back extraction by electrolytic reduction (2B-Battery) were successfully tested during more than 1,000 hours of operation. The mass transfer coefficients obtained for uranium proved that no fundamental difficulties should arise from the scale-up of the apparatus. Experiments with an electrolytic pulse column showed favorable mass transfer coefficients, which are comparable to those of the tested mixer-settler. Flowcells were constructed and successfully tested on the basis of laboratory experiments concerning the anodic oxidation of plutonium between the cycles of the Purex process. (auth)

6107 (ORNL-TM-4836) LMFBR FUEL RECYCLE PROGRAM PROGRESS REPORT FOR PERIOD APRIL 1 TO DECEMBER 31, 1974. Bottenfield, B. F.; Chandler, J. M.; Clinton, S. D.; Duggins, B. C.; Groenier, W. S.; Irvine, A. R.; Mailen, J. C.; Vaughen, V. C. A.; Watson, C. D.; Yarbro, O. O. (Oak Ridge National Lab., Tenn. (USA)). Apr 1975. Contract W-7405-eng-26. 92p. AT.

Use of a plasma torch for cropping LMFBR subassemblies was developed sufficiently that the design of full-scale equipment can proceed immediately. Internal sodium deactivation tests for single sheared lengths of clad urania have been completed with water in a closed, inert-atmosphere system. A Hanford model has been successfully used to describe ORNL data for plutonia dissolution in fluoride-catalyzed nitric acid. Iodine could not be completely removed from nitric acid that had been

purposely contaminated with organics. Iodine partition coefficients between air and nitric acid containing nitrite were measured. Fabrication of the equipment for the Iodox process demonstration is complete. (LK)

6108 (ORNL-TM-4876) PURIFICATION OF RECYCLED NITRIC ACID BY WET AIR OXIDATION. Clark, W. E.; Thompson, C. T.; Howerton, W. B. (Oak Ridge National Lab., Tenn. (USA)). May 1975. Contract W-7405-eng-26. 12p. AT.

To the limits of analytical detection, organic material was removed from nitric acid solutions by wet oxidation at temperatures in excess of 300°C. The observed rate was relatively insensitive to the concentration of nitric acid between 5 and 8 molar. The process is considered as a possible method of purification for nitric acid recycled from nuclear fuel reprocessing procedures. Advantages, disadvantages, and further tests required are listed and discussed. (auth)

6109 REPROCESSING DEMAND AND CAPACITY IN CERTAIN COUNTRIES OF THE WORLD. Com. Naz. Energ. Nucl., Not.; 21: No. 2, 52–54(Feb 1975). (In Italian).

A picture of the present situation and prospects of the nuclear fuel reprocessing services in the USA, Japan and Europe, on both a national and multinational scale. (auth)

CONTROLLED THERMONUCLEAR RESEARCH

6110 (MATT-1(Supp. 4)) BIBLIOGRAPHY OF PLASMA PHYSICS LABORATORY REPORTS AND PUBLICATIONS COVERING THE PERIOD JANUARY 1–DECEMBER 31, 1974. (Princeton Univ., N. J. (USA). Dept. of Physics). May 1975. Contract AT(11-1)-3073. 15p. Dep. NTIS $4.00.

Plasma Confinement and Heating

Refer also to abstract 6167.

6111 (CEA-CONF-2909) THEORY OF SLOW WAVE COUPLING TO THE LOWER HYBRID RESONANCE IN THERMONUCLEAR DEVICES. Brambilla, M. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Physique du Plasma et de la Fusion Controlee). 1974. 24p. INIS.

From summer school symposium on plasma heating in toroidal devices; Varenna, Italy (3 Sep 1974).

It is shown that in large and dense devices the lower hybrid resonance (LHR) is accessible from outside the plasma if the wave is slowed down along the static magnetic field so as to satisfy the Stix-Golant accessibility condition. The multi-waveguide structure (nicknamed grill) proposed for launching such a wave in Wega is discussed. The exact solution for the electromagnetic fields of the "grill" both without and with the plasma as a load is presented. In conclusion, the coupling of the grill to the plasma appears rather poor. The results of the simplified model described show that the protection of an high power generator against mismatching can be a formidable problem indeed. An unwanted absorption and the nonlinear effects in the plasma (possibly beneficial can increase the plasma load and reduce the mismatching. (FR)

6112 (CEA-CONF-2913) SURVEY ON THE RF HEATING RESEARCH ON TOROIDAL DEVICES IN U. S. S. R. Barouch, E.; Gros, M.; Masse, P. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Physique du Plasma et de la Fusion Controlee). 1974. 29p. INIS.

From summer school symposium on plasma heating in toroidal devices; Varenna, Italy (3 Sep 1974).

Figures give the improvements in the T(i) ion temperature attained in Tokamak devices during the last 15 years and the latest best results obtained for T(i), and the product n T(E) (where n is the plasma density per cubic centimeter and T(E) the energy confinement time in milliseconds). The different possible R. F. heating methods with the phenomena involved, the relevant frequencies and wave lengths and finally the power sources required for ignition (between 10 a 100 MW in CW operation) are represented. The major part of the R. F. heating research in U. S. S. R., which is oriented towards plasma heating in toroidal devices is reviewed. The most important toroidal machines and R. F. methods investigated in this research are given. (FR)

6113 (CEA-CONF-2914) A POSSIBLE EXPLANATION OF THE RF-INDUCED PUMPOUT OBSERVED ON LOW-β-TORI. Canobbio, E. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Physique du Plasma et de la Fusion Controlee). 1974. 8p. INIS.

From summer school symposium on plasma heating in toroidal devices; Varenna, Italy (3 Sep 1974).

Anomalous plasma cross-field diffusion has been observed during the heating phase in various large-power RF experiments including TTMP and ICRH. A loss-mechanism is proposed in this paper, which is based on the existence of a new type of low-frequency parametric instability. This instability results from the interaction of a pump wave at frequency ω_0 and arbitrary wave number, with two ion-acoustic waves of frequency ω and $(\omega-\omega_0)$ respectively ($/\omega/ < \omega_0$), both with wave length much larger than the ion Larmor radius (but shorter than the wave length of the pump). Such waves are strongly ion-Landau damped in an almost maxwellian plasma in the absence of the pump. This instability seems to provide a plausible explanation of the losses observed in the TTMP case, and may also be relevant to the ICRH-experiment. (FR)

6114 (CEA-CONF-2915) THE RF-HEATING APPROACH TO IGNITION IN LOW-β-TORI. Canobbio, E. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Physique du Plasma et de la Fusion Controlee). 1974. 15p. INIS.

From summer school symposium on plasma heating in toroidal devices; Varenna, Italy (3 Sep 1974).

The main aspects of the rf-heating approach to the ignition problem in low-beta toroidal devices are discussed. The processes analyzed on some detail are: ion and electron TTMP, ICRH including heating at multiples of the ion gyrofrequency, and heating at the lower hybrid resonance. Emphasis is put on the basic physical scaling laws relevant to ignition, on the essential questions which remain to be settled, and on the main technical constraints upon the application of the various rf-schemes in reactor oriented devices. (FR)

6115 (CONF-720961-11) PLASMA HEATING BY ADIABATIC COMPRESSION. Ellis, R. A. Jr. (Princeton Univ., N. J. (USA). Plasma Physics Lab.). 1972. Contract AT(11-1)-3073. 7p. Dep. NTIS $4.00.

From symposium on plasma heating and injection; Varenna, Italy (21 Sep 1972).

These two lectures will cover the following three topics: (1) The application of adiabatic compression to toroidal devices is reviewed. The special case of adiabatic compression in tokamaks is considered in more detail, including a discussion of the equilibrium, scaling laws, and heating effects. (ii) The ATC (Adiabatic Toroidal Compressor) device which was completed in May 1972, is described in detail. Compression of a tokamak plasma across a static toroidal field is studied in this device. The device is designed to produce a pre-compression plasma with a major radius of 17 cm, toroidal field of 20 kG, and current of 90 kA. The compression leads to a plasma with major radius of 38 cm and minor radius of 10 cm. Scaling laws imply a density increase of a factor 6, temperature increase of a factor 3, and current increase of a factor 2.4. An additional feature of ATC is that it is a large tokamak which operates without a copper shell. (iii) Data which show that the expected MHD behavior is largely observed is presented and discussed. (auth)

6116 (CONF-720961-12) ION CYCLOTRON HEATING EXPERIMENTS ON THE ST TOKAMAK. Hooke, W. (Princeton Univ., N. J. (USA). Plasma Physics Lab.). [nd]. 4p. Dep. NTIS $4.00.

From symposium on plasma heating and injection; Varenna, Italy (21 Sep 1972).

The coil loading in the tokamak plasma was found to be at least as strong as that in a plasma in a uniform magnetic field. In addition, evidence of ion heating at OMEGA equals 1 and OMEGA equals 2 at power levels where heating should be barely detectable was found. It is concluded that a coil designed to couple more efficiency and capable of handling megawatt power levels might be capable of significantly increasing the ion temperatures in tokamaks. (auth)

6117 (CONF-720961-13) NON-LINEAR EFFECTS AND PLASMA HEATING NEAR THE LOWER HYBRID RESONANCE FREQUENCY. Hooke, W. (Princeton Univ., N. J. (USA). Plasma Physics Lab.). 1972. Contract AT(11-1)-3073. 3p. Dep. NTIS $4.00.

From symposium on plasma heating and injection; Varenna, Italy (21 Sep 1972).

A schematic diagram is given of the linear picture of damping at the lower hybrid frequency. The wave is launched from a region near the edge of the plasma where the density is so low that the wave is evanescent. The electric field intensity near the resonance region is described. A physical picture is given of the decay process. (MOW)

6118 (COO-2456-3) STRONG SHOCK WAVE HEATING TO FUSION TEMPERATURES IN STRONG MAGNETIC FIELDS. Taussig, R. T. (Columbia Univ., New York (USA). Plasma Research Lab.). 1975. 4p. (CONF-750218-1). Dep. NTIS $4.00.

From 10th Ainse plasma physics conference; Sydney, Australia (11 Feb 1975).

A two-temperature, one-dimensional magnetohydrodynamic model of a collision-dominated plasma with anisotropic transport properties is used to determine the shock structure and MHD piston dynamics for shock wave heating in hydrogen. Ions are heated preferentially in such shocks and in the special case of antiparallel magnetic fields intense ion heating is also found in the MHD piston region. Computations for coaxial electromagnetic shock tube conditions and for the initial stages of belt pinch heating are compared to recent experimental observations. The possible application of this model to solid density plasmas is also discussed. (auth)

6119 (ERDA-tr-17, pp vp, Paper 8) PROSPECTS FOR THE USE OF HIGH-FREQUENCY METHODS OF HEATING PLASMA IN A QUASISTATIONARY THERMONUCLEAR REACTOR.

Alikaev, V. V. (Inst. of Atomic Energy, Moscow); Golant, V. E.; Stepanov, K. N. 1974 Translation by W. J. Grimes of O Perspektivakh Primeneniya Vysokochastotnykh Metodov Nagreva Plazmy v Kvazistatsionarnom Termoyadernom Reaktore.

From joint USSR-USR seminar; Leningrad, USSR (9 Dec 1974).

In systems analysis and design of thermonuclear stations. (Nauchno-Issledovatel'skij Inst. Ehlektrofizicheskoj Apparatury, Leningrad (USSR)).

The possibilities of using various high-frequency methods for incorporation in the regime of a quasistationary toroidal thermonuclear reactor are discussed. Parameters are used in the evaluation which are characteristic of tokamak reactors. The physical parameters which govern the conditions of interaction of high-frequency waves with plasma are described. (MOW)

6120 (KHFTI-74-43) MEASURING DEVICE FOR POWER ABSORBED BY PLASMA DURING RF HEATING. Kalinchenko, S. S. (AN Ukrainskoj SSR, Kharkov. Fiziko- Tekhnicheskij Inst.). 1974. 12p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The measuring device for transmitted power based on the incident reflected power relation in the long line $\rho = (U^2_{nab} - U^2_{omp})/\rho$ is described. The voltage proportional to the incident and reflected wave is generated in the pickup represented by the combination of the transformer-current and the divisor. Squaring is performed with two nonlinear blocks reproducing the dependence $Y = x^2$. The operational amplifier is used for subtraction of the two values. Power is measured in the range from 10 to 800 kw. The frequency range is from 2 to 12 mcps, the error is up to 20%. (auth)

6121 (KHFTI-74-44) POWER AND SIGNAL-INFORMATION CIRCUITS FOR HF PLASMA HEATING. Kalinichenko, S. S.; Kurilko, P. I.; Shvets, O. M. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1974. 33p. (In Russian). Dep. NTIS (US Sales Only) $4.75.

Various types of hf generators applicable for hf plasma heating purposes are discussed. Various circuits for matching the exciting devices to generators are discussed and different types of feeders are considered. A detailed description is given of practical circuits of different measuring devices. (auth)

6122 (MATT-994) TOKAMAK HEATING BY NEUTRAL BEAMS AND ADIABATIC COMPRESSION. Furth, H. P. (Princeton Univ., N. J. (USA). Plasma Physics Lab.). Aug 1973. Contract AT(11-1)-3073. 15p. (CONF-730705-28). Dep. NTIS $4 00.

From 6th European conference on controlled fusion and plasma physics; Moscow, USSR (30 Jul 1973).

"Realistic" models of tokamak energy confinement strongly favor reactor operation at the maximum MHD-stable beta-value, in order to maximize plasma density. Ohmic heating is unsuitable for this purpose. Neutral-beam heating plus compression is well suited; however, very large requirements on device size and injection power seem likely for a DT ignition experiment using a Maxwellian plasma. Results of the ATC experiment are reviewed, including Ohmic heating, neutral-beam heating, and production of two-energy-component plasmas (energetic deuteron population in deuterium "target plasma"). A modest extrapolation of present ATC parameters could give zero-power conditions in a DT experiment of the two-energy-component type. (auth)

6123 (MATT-1128) OHMIC HEATING OF TOKAMAKS. Hosea, J. C. (Princeton Univ., N. J. (USA). Plasma Physics Lab.). Apr 1975. Contract AT(11-1)-3073. 31p. (CONF-740969-3). Dep. NTIS $4.75.

From symposium on plasma heating in toroidal devices; Varenna, Italy (3 Sep 1974).

Ohmic heating in present generation tokamaks has proven to be efficacious to the extent that it raises the electron temperatures into the keV range and ion temperatures to several hundred of eV. The ultimate temperatures reached have been dictated by the energy confinement time which at present is relatively short (less than or equal to 15 msec). This restriction should be relaxed in future devices in which the discharge duration will be comparable to the confinement time so that the ohmic heating rate should be primarily set by the thermal capacity of the plasma. If this proves to be the case, and if the current density profile can be suitably chosen, ohmic heating will provide a continual "slow" increase in plasma temperature throughout the discharge duration. The current density profile will be strongly dependent on skin effect, stability, and particle influx at the plasma boundary. In present tokamaks, stability and particle influx are dominant but skin effect should play at least as dominant a role in the future machines. There is considerable concern regarding all three of these processes and schemes for avoiding their influence are being pursued. Until now, the usual tokamak operation employing ohmic heating has been limited to beta /sub THETA/ equals anti $p/B^2(a)/8$ pi less than or equal to 1. Stepped ohmic heating current experiments suggest that equilibrium and stability can be maintained to at least beta /sub THETA/ approximately R/a if only the heat input could be increased. Predictions for straightforward enlargements of the conventional design of the tokamak suggest that beta /sub THETA/ will actually decrease. It is possible that selected magnetic geometries can improve the ohmic heating. However, it appears at this time that supplementary heating combined with ohmic heating will provide the higher beta /sub THETA/ values desired for reactor-like operation in the next generation of devices, especially for the relatively short discharge duration times envisioned. (auth)

6124 (MATT-1132) CONFINEMENT OF ENERGETIC ALPHAS IN TCT AND TRITONS IN PLT. Tenney, F. H. (Princeton Univ., N. J. (USA). Plasma Physics Lab.). May 1975. Contract AT(11-1)-3073. 43p. Dep. NTIS $5.25.

The nature of the drift orbits of 3.5 MeV alpha particles in tokamak fields typical of the proposed TCT device is discussed. The drift equations are approximately integrated to obtain orbit equations. A variety of orbits are displayed including near "stagnation" orbits. An estimate is made of the initial confinement of 3.5 MeV alphas in TCT and 1.0 MeV tritons in PLT. (auth)

6125 (N-74-27232) HOT ION PLASMA HEATING EXPERIMENTS IN SUMMA. Reinmann, J. J.; Lauver, M. R.; Patch, R. W.; Posta, S. J.; Snyder, A.; Englert, G. W. (National Aeronautics and Space Administration, Cleveland, Ohio (USA). Lewis Research Center). 1974. 42p. (CONF-740559-6). NTIS $3.25.

From conference on plasma science; Knoxville, Tennessee, USA (15 May 1974).

Initial results are presented for the hot-ion plasma heating experiments conducted in the new SUMMA (superconducting magnetic mirror apparatus) at NASA Lewis Research Center. A discharge is formed by applying a radially inward dc electric field between cylindrical anodes and hallow cathodes located at the peak of the mirrors. Data were obtained at midplane magnetic field strengths from 1.0 to 3.5 tesla. Charge-exchange neutral particle energy analyzer data were reduced to ion temperatures using a plasma model that included a Maxwellian energy distribution superimposed on azimuthal drift, finite ion orbits, and radial variations in density and electric field. The best ion temperatures in a helium plasma were 5 keV and in hydrogen the H2(+) and H(+) ions were 1.2 keV and 1 keV respectively. Optical spectroscopy line broadening measurements yielded ion temperatures about 50 percent higher than the charge-exchange neutral particle analyzer results. Spectroscopically obtained electron temperature ranged from 3 to 30 eV. Ion temperature was found to scale roughly linearly with the ratio of power input-to-magnetic field strength, P/B. (auth)

6126 (NP-20374) LASER BEAM PROPAGATION IN A LONG SOLENOID. Mani, S. A.; Eninger, J. E.; Wallace, J. (Avco-Everett Research Lab., Everett, Mass. (USA)). Jan 1975. 23p. Avco-Everett Research Lab., Inc., Everett, MA.

An analysis of the propagation of a laser beam in a cylindrical magnetically confined plasma with parabolic density profile is presented. The normal modes which are self-trapped are given. It is found that the largest mode that can be trapped by the plasma is given by $\frac{1}{2}(R_0^2/w^2 - 1)$ where R_0 is the radius of the plasma column and w is the fundamental mode width. It is found that all the trapped modes in a finite plasma can easily propagate distances of the order of one kilometer. An exact solution for the amplitude of the electric field for an incident gaussian beam was obtained. The solution exhibits alternate focusing and defocusing of the beam. The effect of this on the plasma heating is discussed. (auth)

Plasma Diagnostics

6127 (COO-2229-8) ADVANCES IN ELECTROSTATIC ENERGY ANALYZERS FOR ION BEAM PROBE DIAGNOSTIC SYSTEMS. Bird, L. A.; Glowienka, J. C.; Jennings, W. C.; Hickok, R. L. (Rensselaer Polytechnic Inst., Troy, N. Y. (USA). Plasma Dynamics Lab.). 1974. Contract AT(11-1)-2229. 6p. (CONF-741079-7). Dep. NTIS $4.00.

From 16th annual meeting of the plasma physics division of the American Physical Society; Albuquerque, New Mexico, USA (28 Oct 1974).

Two new concepts are discussed for feedback controlled electrostatic energy analyzers; a dual gain analyzer for current density measurements, and bottom plate coupling to provide dc stability and better frequency response. An analyzer incorporating both of these concepts was built and preliminary measurements of its performance were made. These measurements are not reported here. (auth)

6128 (EUR-CEA-FC-746) WALL PROBES. Olivain, J. (Association Euratom-CEA, Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Groupe de Recherches sur la Fusion Controlee; CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Physique du Plasma et de la Fusion Controlee). Jul 1974. 41p. (In French). INIS.

The static wall probe is defined essentially as a metallic collecting surface placed outside the plasma and more precisely on the inner surface of the liner surrounding this latter. Under the action of a plasma-induced oscillating electric field the antenna becomes superficially charged and gives rise to a current measured by a charge. The functioning of such an antenna is analyzed. An experimental test was carried out on a simulated model in order to check the working theory and to determine the uncertainty limits of the technique. The results obtained with a plasma consisting of a column surrounded by a cylindrical guide are discussed. A generalization of these results is proposed and the technique is shown to apply to many types of plasma waves, including dense and hot plasmas in particular. (FR)

6129 (IPP-III-15) METHOD TO MEASURE VERY HIGH DC CURRENTS WITH ACTIVE INTEGRATORS. Gernhardt, J.; Groening, D. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F. R. Germany)). Dec 1974. 13p. (In German). Dep. NTIS (US Sales Only) $4.00.

In order to measure very high dc currents (~10 kA) a pick-up-coil with an active integrator insulated from ground is used. The pulse-length of the dc current can be several seconds. Properties of the pick-up coil and the magnetic field produced by the bus-bar current are described. A description of the integrator and the electrical circuit is given. (auth)

6130 (IPP-IV-80) ABSORPTION AND SCATTERING OF NEUTRAL PARTICLE BEAMS USED FOR THE DETERMINATION OF PLASMA PARAMETERS. Mayer, H. M. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F. R. Germany)). Feb 1975. 16p. Dep. NTIS (US Sales Only) $4.00.

The processes which dominate the passage of neutral particle beams through a fully ionized hydrogen plasma are analyzed from a diagnostic point of view. In particular He and Ne beams are considered as they are the most penetrating ones which can give pronounced limiting angle scattering. The dependence of attenuation on T_e, T_i of a He beam and the scattering of a Ne beam are discussed in more detail. (auth)

6131 (IPPJ-181, pp 1-8) DESIGN OF SIN-COS-PROBE FOR ETL-TPE-1. Yahagi, E. Dec 1973.

From symposium on plasma diagnostics; Nagoya, Japan (21 Feb 1973).

In the record of symposium on plasma diagnostics. (Nagoya Univ. (Japan). Inst. of Plasma Physics).

A sin-cos-probe for ETL-TPE was designed. First of all, the magnetic field in a nested toroid was analyzed. A toroidal metal shell with toroidal radius R_t and poroidal radius 6 including a conducting toroid with poroidal radius a in it was assumed. The components in γ and θ directions of the magnetic field were obtained. The sin-cos-probe consists of three coils, each of which is wound around an identical toroidal spool. The calculated values of the output of these coils can be obtained by performing the in integral $\int_0^{2\pi} H_\theta(\theta)\, q(\theta)\, d\theta$ in the complex domain for each coil, where $H_\theta(\theta)$ is the θ component of the magnetic field, and $q(\theta)$ is the number of turns per unit length of the coils. Geometrical requirements of the probe for TPE-1 are described. Electrical requirements are withstand voltage higher than 30 kV, consideration for the effect of strong toroidal magnetic field which may be about thirty times as strong as the poroidal field, cos-coil signal V_c greater than 0.5 mV, frequency characteristics wider than the range from 1 kHz to 15 MHz, and observable signal within error of 1%. The final value of the total number Nr of turns of a reference coil is decided after measuring the inductance of the cos- and sin-coils. (JA)

6132 (IPPJ-181, pp 9-12) LOW FREQUENCY OSCILLATION IN A HIGH DENSITY PLASMA. Nishida, Y.; Ishii, K. Dec 1973.

From symposium on plasma diagnostics; Nagoya, Japan (21 Feb 1973).

In the record of symposium on plasma diagnostics. (Nagoya Univ. (Japan). Inst. of Plasma Physics).

Experimental results and its interpretation in a diffused high density plasma without parallel current are presented. It is shown that the coupled mode of colliding Alfvén wave and colliding drift wave can exist. Experiments were performed with TPD machine of Nagoya Univ. The helium plasma produced by the arc discharge of the current of max. 100A was diffused through an anode orifice. Steady state values and ion-density fluctuation were measured with an optical probe which had been constructed with an optical guide and a photo-multiplier. The optical signal detected was only He-II line intensity. Fluctuating signals were analyzed by real time auto- and cross-correlation method, and with a spectrum analyzer. The rotation velocity and density of plasma were measured by the Doppler shift of He-II line and with CN laser, respectively. Magnetic fluctuation was detected with a magnetic probe. The relations between instability spectra and ion density profile, and instability frequency and amplitude vs. magnetic field strength were obtained. It was found that half wave length can be determined by the length between anode and a target. Interpretation of this instability was tried as the coupled mode of colliding Alfvén instability and colliding drift mode. (JA)

6133 (IPPJ-181, pp 13-22) DISTRIBUTION MEASUREMENT IN K-SPACE OF ION ACOUSTIC WAVE BY MICROWAVE SCATTERING. Mase, A.; Yamamoto, T.; Tsukishima, T. Dec 1973.

From symposium on plasma diagnostics; Nagoya, Japan (21 Feb 1973).

In the record of symposium on plasma diagnostics. (Nagoya Univ. (Japan). Inst. of Plasma Physics).

Experimental results are presented concerning the microwave scattering from ion acoustic wave excited externally in a mercury positive column, with emphasis on the measurement of the intensity distribution of the ion acoustic wave in wave vector (K) space. Plasma was produced in a glass tube with 5 cm i.d. and 40 cm length. The ion acoustic wave was excited via an asterisk grid. The microwave of frequency $\omega_i/2\pi = 35$ GHz was launched through a transmitter horn, and focused on a discharge tube with a dielectric lens. The plasma column was in the far field of horns. The scattered signal picked up with a receiver horn was detected by a homodyne system. Correlator output P_r was obtained as the function of scattering angle, the zenithal angle α, and the illuminating position as measured from the exciting grid toward an anode. It was seen that wave intensity showed the maximum at $\alpha = 0$. The wave attenuation as it propagated toward the anode was also seen. The attenuation was heavy and exponential for $f = 30$ kHz. It is interesting to note that the heavier attenuation was accompanied by wider angular spread in the K space. (JA)

6134 (IPPJ-181, pp 23-29) REVIEW OF PARTICLE DIAGNOSTICS. Inoue, N. Dec 1973.

From symposium on plasma diagnostics; Nagoya, Japan (21 Feb 1973).

In the record of symposium on plasma diagnostics. (Nagoya Univ. (Japan). Inst. of Plasma Physics).

In this review, the particle measurement which is applicable to a closed magnetic confinement system is presented. Mass and energy analysis of the neutral particles produced by the charge exchange reaction between plasma ions and residual gas offers the informations about energy distribution and the ion species of plasma. An apparatus for the measurement is shown. The measurement of charged particles may be fruitful if the observed results are interpretable by the diffusion theory of toroidal plasma. It is necessary to analyse and detect the charged particles at plasma surface. Nuclear reaction can be used for the estimation of ion temperature from the observed total neutron yield. It should be noticed that the reaction rate is much sensitive to the high energy part of energy distribution, and the deviation of the distribution from Maxwellian leads to large error. A beam probe system used for the measurement of ion density is shown, and beam intensity after the transmission of the plasma with thickness L and density n is given for neutral particle beam. Heavy ion beam-probe technique has been developed for the measurement of ST TOKAMAK plasma. Toroidal current distribution can also be obtained. Electron beam has been used for the measurement of space potential and the trace of magnetic field. (JA)

6135 (IPPJ-181, pp 31-41) SPECTRAL LINE PROFILE AND ITS APPLICATION TO PLASMA DIAGNOSTICS. Oda, T. Dec 1973.

From symposium on plasma diagnostics; Nagoya, Japan (21 Feb 1973).

In the record of symposium on plasma diagnostics. (Nagoya Univ. (Japan). Inst. of Plasma Physics).

The profile of spectral lines from plasma gives information concerning the properties of the plasma. Some examples of the recent results of research are presented in this report on the shape of the spectral lines due to Doppler and/or Stark effect. The temperature or the velocity distribution of ions may be obtained by measuring the line profile, except those far high temperature plasma. In case of the high temperature plasma, Doppler broadening measurement may be possible if a small amount of natural atoms is put into the plasma. An example of such measurement is shown. The Doppler effect due to plasma mass motion is another problem for the measurement. Some result of the Doppler broadening measurement for the plasma of tur-

bulent heating experiment is presented. Decay of the profile of helium ion lines during heating process was obtained, and mass motion in the plasma is suggested. Stark broadening of the spectral line from plasma gives information for the transport phenomena and heating in turbulent plasmas. High frequency strong electric field influences the radiating lines for producing satellite lines through more than one quantum number. It was on He I lines that the first experiment on the satellite lines was performed. Other experiments, such as the experiments on not so strong field and low frequency field are also explained. (JA)

6136 (IPPJ-181, pp 42-47) AN ATTEMPT TO DETERMINE ELECTRON TEMPERATURE BY THE MEASUREMENT OF LYMAN STEP OF HELIUM ION CONTINUUM. Ohsumi, S.; Ishimura, T. Dec 1973.

From symposium on plasma diagnostics; Nagoya, Japan (21 Feb 1973).

In the record of symposium on plasma diagnostics. (Nagoya Univ. (Japan). Inst. of Plasma Physics).

In this paper, some experimental study to examine a method to determine the electron temperature of high temperature plasma is reported. Although the principle of measurement of electron temperature is well known, the actual application to high temperature plasma has not yet been carried out because of technical difficulties. In this experiment, a grazing incidence monochromator equipped with a concave grating of 1 m radius of curvature was used to measure the intensity of continuum on both sides of Lyman series limit of ionized helium. A detector is an open window type photomultiplier with tungsten photocathode. As preliminary experiment, helium plasma produced with a theta pinch gun was chosen as the subject of spectroscopic measurement. From the ratio of peak intensity, the electron temperature of the plasma was estimated to be (23 ± 5) eV. A theta pinch machine was constructed for the purpose to pursue this plan. Typical time sequence of the intensity of continuum on both sides of Lyman series limit is shown in the case in which the charging voltage of main bank was 35 kV and the pressure of helium gas was 50 mtorr. In this case, pinch time was about 1μs, the diameter of pinched plasma was about 5 cm, and the time of current maximum was 2μs after the fire of the main bank. The time-resolved electron temperature was obtained from the ratio of the continuum intensity on shorter wavelength side to that of longer one. (JA)

6137 (IPPJ-181, pp 48-61) MEASUREMENT OF THE ABSOLUTE INTENSITY OF RADIATION IN THE SOFT X-RAY AND EXTREME ULTRAVIOLET REGION. Sugawara, H.; Sasaki, T.; Oda, T. Dec 1973.

From symposium on plasma diagnostics; Nagoya, Japan (21 Feb 1973).

In the record of symposium on plasma diagnostics. (Nagoya Univ. (Japan). Inst. of Plasma Physics).

A new method for the measurement of absolute intensity of radiation in extreme ultraviolet (XUV) region by means of the energy analysis of photoelectrons was proposed. The radiation emitted by a 1.3 GeV electron synchrotron is introduced to a 0.5 m Seya type monochromator followed by a double ionization chamber. The end of the chamber may be terminated by a detector B or other devices to be calibrated. A part of beam is interrupted with a mirror M in front of entrance slit, and led to a detector A, which is not necessarily sensitive to XUV, but may be of any conventional type, for instance, an ordinary photomultiplier. Two ion currents i_1 and i_2 of the double ionization chamber are measured for the determination of photon flux I_0 coming out of the monochromator. Some examples are presented on the application of this method. The results above 30 eV obtained by this method are less reliable, and a method applicable to higher photon energy region was proposed. The energy level scheme of helium ions is the simplest of all rare gases as it is like hydrogen, and it is most suitable for the present purpose. If gas is irradiated by monochromatic radiation, there will result in many groups of photoelectrons. Any type of electron energy analyzer may be used for the present purpose, and a system used for the experiment is shown. (JA)

6138 (IPPJ-181, pp 62-69) LASER LIGHT SCATTERING FROM A TURBULENTLY HEATED PLASMA. Kondo, K. Dec 1973.

From symposium on plasma diagnostics; Nagoya, Japan (21 Feb 1973).

In the record of symposium on plasma diagnostics. (Nagoya Univ. (Japan). Inst. of Plasma Physics).

Laser scattering is promising diagnostic technique to obtain informations about the electron velocity distribution with high spatial and temporal resolution. The electron velocity distribution can be determined from the spectrum of scattered light broadening by the Doppler effect, on condition that scattering parameter $\alpha = \lambda/(4\pi\lambda_D \sin\theta/2)$ is less than 1, where λ is 6943 Å, λ_D electron Debye length, and θ scattering angle. The relation between the intensity of incident laser beam and scattered beam was analysed. There are two methods to obtain electron density, the first is to count absolute photon number scattered from plasma electrons, the other to calibrate whole optical system by means of Rayleigh scattering from neutral gas. The lower limit of the electron density to be measured by laser light scattering can be checked by means of the Rayleigh calibration. In actual optical system, stray light gives the lowest electron density to be measured. The relation between the stray light and Rayleigh scattered light was obtained. One of the examples of the spectra before and during turbulent heating process is shown. Some definite difference was observed between the spectrum profile of initial and heated plasmas. (Kato, T.)

6139 (IPPJ-181, pp 70-75) RELATIVISTIC CORRECTIONS TO THE SPECTRUM OF SCATTERED LIGHT FROM A HIGH TEMPERATURE PLASMA. Hayase, K.; Okuda, T. Dec 1973.

From symposium on plasma diagnostics; Nagoya, Japan (21 Feb 1973).

In the record of symposium on plasma diagnostics. (Nagoya Univ. (Japan). Inst. of Plasma Physics).

Laser scattering provides the local values of electron temperature, density and turbulence without perturbing plasma. The theory of light scattering used for experiment was developed for cold electrons, and relativistic correction seems to be necessary for the practical application to the experiment of theta-pinch or Tokamak. The relativistic correction for thermal plasma can be calculated by taking into account the relativistic Maxwellian distribution of electron velocity. It is expected that the tail of Gaussian profile of the spectrum of scattered light is modified. The modification of scattering cross-section in a high energy region and its effect on temperature estimation are considered. The electromagnetic wave scattered by a single electron is expressed. The scattering cross-section for the electron with velocity V_x in x direction is calculated as a ratio to the cross-section for non-relativistic electron. Scattering cross-section for beams with V_Y and V_z was also obtained. The cross-section increases abruptly with $\beta_y = V_y/c$ while it decreases with $\beta_z = V_z/c$ and $\beta_x = V_x/c$. The relativistic correction seems necessary at β larger than 0.1. Broadening of the spectrum of scattered light due to the distribution of electron velocity is discussed. (Kato, T.)

6140 (IPPJ-T-21) AN ORIENTABLE SECONDARY EMISSION DETECTOR FOR PLASMA EXPERIMENTS. Deck, C.; Iguchi, H.; Jacquinot, J.; Kawabe, T. (Nagoya Univ. (Japan). Inst. of Plasma Physics). May 1974. 17p. INIS.

An orientable secondary emission detector is described. Its response to the fast neutral atom flux emitted by a plasma allows to measure the density profile, the phase space distribution function and the average energy of the plasma ions. (auth)

6141 (LA-5895-MS) ION TEMPERATURE MEASUREMENT BY LASER SCATTERING AT 2.8 GAMMA. DeSilva, A. W. (Los Alamos Scientific Lab., N. Mex. (USA)). Feb 1975. Contract W-7405-ENG-36. 9p. Dep. NTIS $4.00.

Laser scattering using 2.8 mu radiation is considered as a means of measuring ion temperatures on Scyllac. Both suitable detectors and a laser with sufficient power are presently available. It is concluded that such measurements are certainly feasible. However, the self-imposed restriction that no special windows or ports be allowed in the quartz vacuum vessel makes the rejection of stray light difficult. (auth)

6142 (N-74-27234) SPECTROSCOPIC RESULTS IN HELIUM FROM THE NASA LEWIS BUMBY TORUS PLASMA. Richardson, R. W. (National Aeronautics and Space Administration, Cleveland, Ohio (USA). Lewis Research Center). 1974. 22p. (CONF-740559-3; NASA-TM-X-71569; E-8006). NTIS $3.00.

From conference on plasma science; Knoxville, Tennessee, USA (15 May 1974).

Spectroscopic measurements were carried out on the NASA Lewis Bumpy Torus experiment in which a steady state ion heating method based on the modified Penning discharge is applied in a bumpy torus confinement geometry. Electron temperatures in pure helium are measured from the ratio of spectral line intensities. Measured electron temperatures range from 10 to 100 eV. Relative electron densities are also measured over the range of operating conditions. Radial profiles of temperature and relative density are measured in the two basic modes of operation of the device called the low and high pressure modes. The electron temperatures are used to estimate particle confinement times based on a steady state particle balance. (auth)

6143 (UCID-16775) X-RAY CALIBRATION OF KODAK NO-SCREEN, TYPE AA, AND TYPE M IN THE 1-4.5 keV REGION. Stoering, J. P.; Toor, A. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 8 May 1975. Contract W-7405-Eng-48. 30p. Dep. NTIS $4.50.

The response of three Kodak x-ray films, No-screen, type AA and type M has been measured at 0.93, 1.5, and 4.5 keV. These measurements were motivated by a need for a radiographic calibration applicable to the analysis of x-ray images produced by an x-ray microscope. This instrument is in current use to study x-rays generated by laser-induced plasmas. By appropriate filter selection, the microscope will focus narrow energy bands between 0.5 and 8 keV. (auth)

6144 ELECTRIC PROBES IN STATIONARY AND FLOWING PLASMAS: THEORY AND APPLICATION. Chung, P. M.; Talbot, L.; Touryan, K. J. Applied Physics and Engineering, Volume 2. New York; Springer-Verlag New York Inc. (1975). 111p.

A discussion is given of the fundamental definitions and key parameters governing the electric probe measurement techniques. This is followed by a chapter devoted to collisionless and transitional probe behavior in quiescent as well as flowing plasmas. The continuum regime of probe operation and special topics, for example, probe surface integrity and probe measurements in turbulent flows and magnetic fields are discussed. (MOW)

6145 MASS-SPECTROMETRIC STUDY OF THE ELEMENTARY PROCESSES IN GAS DISCHARGE PLASMA. Egorov, N. P.; Komarov, V. N.; Kupriyanov, S. E. Khim. Plazmy; No. 1, 203-233(1974). (In Russian).

The purpose of this review is the description of those areas of study of gas-discharge plasmas in which the use of mass spectrometers appears very promising. Questions of experimental techniques are examined. Those works in which ion and neutral components of the plasma are analyzed are discussed in detail. (132 references) (JSR)

Plasma Kinetics (General)

Refer also to abstract 7972.

6146 (RISO-321) EFFECT OF BOUNDARY LAYER ON THE SEPARATION DISTANCE MAGNETICALLY DRIVEN SHOCK TUBE. Chang, C. T. (Danish Atomic Energy Commission, Risoe. Research Establishment). Feb 1975. 12p. Dep. NTIS (U. S. Sales Only) $4.00.

An investigation was made of the possible effect of the boundary layer on the lack of separation observed between the shock and the current sheath in a magnetically driven shock tube operating under discharge conditions of high voltage and low pressure. Since the calculated and the observed maximum displacement thickness in the pressure range investigated was around 1 mm only, it was concluded that the presence of a viscous layer at the wall cannot be of importance. Instead, the observed lack of separation is most likely due to the leakage of the compressed gas through the current-sheath, and to the diffusive nature of the driving current. (auth)

6147 (UCLA-34P157X8) JOINT EXPERIMENTAL-THEORETICAL PROGRAM IN PLASMA PHYSICS OF CONTROLLED FUSION FOR THE PERIOD JANUARY 1, 1975-DECEMBER 31, 1975. Fried, B. D.; Dawson, J. M.; Weng, A. Y.; Chen, F. F. (California Univ., Los Angeles (USA)). 1975. Contract AT-(11-1)-34. 123p. Dep. NTIS $9.25.

Summaries of research work during this report period are given for the following topics: (1) theoretical studies, (2) laser-plasma studies, (3) computer simulation of plasmas, and (4) experiments on plasma properties and plasma heating. (MOW)

6148 MICROWAVE PERTURBATION OF THE NEGATIVE GLOW FROM A GLOW DISCHARGE. Bloyet, J. (Paris-11 Univ., 91- Orsay (France). Lab. de Physique des Plasmas). Rev. Phys. Appl.; 9: No. 6, 981-987(Nov 1974). (In French).

An applied electromagnetic wave increases the thermal energy of the electrons of a gaseous discharge. This energy increase can modify certain microscopic processes in the discharge and thereby modify the discharge current. The negative glow of an argon discharge illuminated by a high frequency signal are discussed in detail.

6149 QUANTUM MECHANICAL CALCULATIONS FOR THE ELECTRON IMPACT BROADENING AND SHIFT OF THE LINE $4^3S \rightarrow 2^3P$ OF HELIUM IN HOT PLASMA. Bassalo, J. M. (Para Univ., Belem, Brazil); Yamamoto, Y.; Cattani, M. Can. J. Phys.; 53: No. 7, 683-688(1 Apr 1975).

The quantum mechanical formalism developed by Bassalo and Cattani was used to calculate the broadening and shift produced by electronic collisions of the $4^3s \rightarrow 2^3p$ line of helium in a plasma. The effect of the ions is also taken into account. The theoretical predictions are compared with the experimental results of Boetticher et al. and with the semiclassical estimates of Griem et al. (auth)

Plasma Kinetics (Theoretical)

6150 (CONF-7306115-P1, pp B.I1-B.I27) COMPUTERS IN PLASMA PHYSICS. Roberts, K. V. (United Kingdom Atomic Energy Authority, Abingdon, Eng.). 1973.

From 3rd international colloquium on advanced computing methods in theoretical physics; Marseille, France (25 Jun 1973).

In third international colloquium on advanced computing methods in theoretical physics, Marseille, June 25-29, 1973. (Centre National de la Recherche Scientifique, 13- Marseille (France). Centre de Physique Theorique).

Computers are used in plasma physics in many different ways. One of the most important and characteristic tasks has always been the solution of initial-value problems, in which the time evolution of real or idealized plasma systems is simulated on the computer. The basic particle and field equations are precisely known but are much too difficult to solve numerically in practice; therefore, theoretical models have to be introduced. The first type of model, based on Vlasov's equation for the 1-particle distribution function of a collisionless plasma, has led to the technique of particle simulation, while the second type includes various magnetohydrodynamic fluid models which are solved by mesh techniques, although here much further numerical analysis needs to be done. Because the structure of an initial-value code can to a considerable extent be formalized there are great opportunities for symbolic manipulation and automatic program construction. Two complementary methods are briefly mentioned, one based on Algol and the other on Fortran. (auth)

6151 (CONF-7306115-P1, pp B.V1-B.V23) WATERBAG METHOD FOR FLUID SIMULATIONS. Potter, D.; Tuttle, G. H. (Imperial Coll. of Science and Tech., London). 1973.

From 3rd international colloquium on advanced computing methods in theoretical physics; Marseille, France (25 Jun 1973).

In third international colloquium on advanced computing methods in theoretical physics, Marseille, June 25-29, 1973. (Centre National de la Recherche Scientifique, 13- Marseille (France). Centre de Physique Theorique).

Point Lagrangian methods in one dimension were extended to two and three dimensions by defining contours and surfaces in two and three dimensions, respectively. In two dimensions, by using the concept of a contour or "waterbag" rather than a point, an orthogonal Lagrangian space may be defined. Thus the advantages of both a Lagrangian mesh and orthogonal co-ordinates can be obtained. An "exact" matrix method of determining the orthogonal co-ordinates at each timestep is presented. Implicit methods, by which the advective equations may be resolved on this space, are introduced and stable solutions obtained under conditions considerably exceeding the Courant-Friedrichs-Lewy are given. (auth)

6152 (CONF-750339-1) STATE VARIABLE MODEL OF A TOKAMAK THERMONUCLEAR DEVICE. Bailey, J. M.; Miskell, R. V. (Tennessee Univ., Knoxville (USA); Oak Ridge National Lab., Tenn. (USA)). 1972. 7p Dep. NTIS $4.00.

From seventh annual southeastern symposium on system theory; Auburn, Alabama, USA (20 Mar 1975).

A model was developed to simulate the TOKAMAK system. The model considers the eddy current control in the shell and the Shafranov equilibrium equation. The fundamental control variables in the model are the coil current for the vertical field and the plasma temperature. (auth)

6153 (CONF-75060-1) COLLISIONAL FUNCTIONAL REPRESENTATION. Meier, H. K.; van Rij, W. I.; Beasley, C. O. Jr. (Oak Ridge National Lab., Tenn. (USA)). 1973. 5p. Dep. NTIS $4.00.

From 7th conference on numerical simulation of plasmas; New York, New York, USA (2 Jun 1975).

The present code runs in the drift kinetic approximation with one spatial coordinate, theta, the poloidal angle. There is no radial or toroidal dependence. The code was used successfully to obtain equilibria and transport coefficients from just inside the banana regime, across the plateau and well into the Pfirsch-Schlueter regime. The code can be extended to include the self consistent electric field so that the trapped particle modes can be studied. It can also be extended to include a radial and eventually a toroidal spatial dependence, so that all of neoclassical physics can be examined. (MOW)

6154 (COO-2059-43) TWO-DIMENSIONAL TURBULENCE IN INVISCID FLUIDS OR GUIDING CENTER PLASMAS. Seyler, C. E. Jr.; Salu, Y.; Montgomery, D.; Knorr, G. (Iowa Univ., Iowa City (USA). Dept. of Physics and Astronomy). Jan 1975. 58p. Dep. NTIS $6.00.

Analytic theory for two-dimensional turbulent equilibria for the inviscid Navier-Stokes equation (or the electrostatic guiding

center plasma) is tested numerically. A good fit is demonstrated - for the approach to a predicted energy per Fourier mode obtained from the two-temperature canonical ensemble of Kraichnan: [parallel u(k) parallel ^{2}] equals (alpha + beta k^2)$^{-1}$, where k is the wave number and alpha and beta are reciprocal energy and enstrophy temperatures. Negative as well as positive temperature regimes are explored. Fluctuations about the mean energy per mode also compare well with theory. In the regime alpha less than O, beta greater than O, with the minimum value of alpha + beta k^2 near zero, contour plots of the stream function reveal macroscopic vortex structures similar to those seen previously in discrete vortex simulations by Joyce and Montgomery. Kraichnan's assertion that thermodynamic limits exist for the negative temperature states is questioned. Eulerian direct interaction equations, which can be used to follow the approach to inviscid equilibrium, are derived. (auth)

6155 (N-74-27233) GUIDING CENTER MODEL TO INTERPRET NEUTRAL PARTICLE ANALYZER RESULTS. Englert, G. W.; Reinmann, J. J.; Lauver, M. R. (National Aeronautics and Space Administration, Cleveland, Ohio (USA). Lewis Research Center). 1974. 21p. (CONF-740559-5; NASA-TM-X-71555; E-7980). NTIS $3.00.

From conference on plasma science; Knoxville, Tennessee, USA (15 May 1974).

The theoretical model is discussed, which accounts for drift and cyclotron components of ion motion in a partially ionized plasma. Density and velocity distributions are systematically prescribed. The flux into the neutron particle analyzer (NPA) from this plasma is determined by summing over all charge exchange neutrals in phase space which are directed into apertures. Especially detailed data, obtained by sweeping the line of sight of the apertures across the plasma of the NASA Lewis HIP-1 burnout device, are presented. Selection of randomized cyclotron velocity distributions about mean azimuthal drift yield energy distributions which compared well with experiment. Use of data obtained with a bending magnet on the NPA showed that separation between energy distribution curves of various mass species correlate well with a drift divided by mean cyclotron energy parameter of the theory. Use of the guiding center model in conjunction with NPA scans across the plasma aid in estimates of ion density and E field variation with plasma radius. (auth)

6156 (SAND-75-5231) COUPLED ELECTRON/PHOTON TRANSPORT IN STATIC EXTERNAL MAGNETIC FIELDS. Halbleib, J. A. Sr.; Vandevender, W. H. (Sandia Labs., Albuquerque, N. Nex. (USA)). [nd]. 8p. (CONF-750703-6). Dep. NTIS $4.00.

From IEEE annual conference on nuclear and space radiation effects; Arcata, California, USA (14 Jul 1975).

A model is presented which describes coupled electron/photon transport in the presence of static magnetic fields of arbitrary spatial dependence. The method combines state-of-the-art condensed-history electron collisional Monte Carlo and single-scattering photon Monte Carlo, including electron energy-loss straggling and the production and transport of all generations of secondaries, with numerical field integration via the best available variable-step-size Runge-Kutta-Fehlberg or variable-order/variable-step-size Adams PECE differential equation solvers. A three-dimensional cartesian system is employed in the description of particle trajectories. Although the present model is limited to multilayer material configurations, extension to more complex material geometries should not be difficult. Among the more important options are (1) a feature which permits the neglect of field effects in regions where transport is collision dominated and (2) a method for describing the transport in variable-density media where electron energies and material densities are sufficiently low that the density effect on electronic stopping powers may be neglected. (auth)

6157 (SU-IPR-497) VIRTUAL MEMORY UTILIZATION IN LARGE PLASMA SIMULATION CODES. Barnes, C. (Stanford Univ., Calif. (USA). Inst. for Plasma Research). Nov 1972. Contract AT(04-3)-799. 48p. Dep. NTIS $5.50.

Large two and three dimensional plasma simulation codes require the use of large slow storage devices such as magnetic discs as extensions to fast store. Both particle (or fluid) quantities and field quantities must reside on disc, making random access to the entire field arrays impossible. A method of bookkeeping which requires only a subset of the field arrays to be in core at one time and which minimizes lost computer time due to I/O wait is described. Particles are treated in groups, each of which resides in a local region of the plasma, necessitating the simultaneous presence in core of only those field quantities overlapping that region. A method of implementing field solvers which use fast Fourier transforms is given which is useful when the field arrays are too large to fit in core. (auth)

6158 NON-IDEAL PLASMA. Yanubov, I. T. Khim. Plazmy; No. 1, 120-155(1974). (In Russian).

A critical review is presented of recent studies on non-ideal plasmas. Interparticle interactions and the criterion of non-ideality are discussed. The movement of an electron in a system of disordered scatterers is examined. The characteristics of a weakly ionized non-ideal plasma are described. The interaction between charged particles in a partially ionized plasma is examined. Positively charged clusters are discussed. (131 references) (JSR)

6159 TRANSVERSE DIFFUSION IN A PLASMA WITH NON-ZERO RESISTIVITY (GUIDING-CENTER APPROXIMATION). Le Queau, D.; Laval, G.; Pellat, R. (Ecole Polytechnique, 75-Paris (France). Centre de Physique Theorique). Compt. Rend., Ser. A, B; 279: No. 17, 447–450(21 Oct 1974). (In French).

A theory is developed to calculate the convective diffusion coefficient associated to low frequency and high wave length modes due to the plasma resistivity. It is shown that such a coefficient leads to an energy diffusion much higher than the corresponding particle diffusion.

Plasma Production

6160 (LA-5703-SR(Rev.)) LASER FUSION TARGET FABRICATION. Status Report, 30 April 1974. Fries, R. J.; Farnum, E. H. (Los Alamos Scientific Lab., N. Mex. (USA)). Nov 1974. Contract W-7405-eng-36. 23p. Dep. NTIS $4.00.

The laser fusion target fabrication effort at Los Alamos Scientific Laboratory has been successful in producing targets of the general design requested by, and with a range of parameters acceptable to, the theoretical designers and to the laser/target interaction physics experimentalists. Many novel techniques for handling and measuring the properties of various types of hollow microballoons were developed. (auth)

6161 (LA-UR-74-1956) METHODS TO REDUCE THE EFFECTS OF SELF LASING TARGET REFLECTIONS IN CO_2 LASERS. Reichelt, W. H.; Landahl, C. E.; Stark, E. E.; Stratton, T. F. (Los Alamos Scientific Lab., N. Mex. (USA)). 1974. Contract W-7405-ENG-36. 6p. (CONF-750520-3). Dep. NTIS $4.00.

From IEEE Optical Society of American conference on laser engineering and applications; Washington, District of Columbia, USA (28 May 1975).

High gain CO_2 laser systems are subject to self-lasing and effects of amplified target reflections. Methods to reduce and eliminate these are reported. (auth)

6162 (SAND-75-5417) ELECTRON BEAM FUSION TARGETS. Clauser, M. J.; Sweeney, M. A. (Sandia Labs., Albuquerque, N. Mex. (USA)). 1975. 17p. (CONF-750531-1). Dep. NTIS $4.00.

From IEEE international conference on plasma science; Ann Arbor, Michigan, USA (14 May 1975).

The behavior of the DT filled gold shells when irradiated by a variety of pulse shapes was studied. In these pulses the power (and beam current) was varied, but the voltage was kept constant at 1 MeV. In general the performance of the target, for a given peak power, was not significantly affected by the pulse shape. Pulses with rise times of up to half the implosion time do not significantly degrade the target performance. The use of the "optimal pulse" of laser fusion with a fixed peak power does not appear to improve the performance of these targets. The main function of the "optimal pulse" is to produce a large rho r of the target during the thermonuclear burn. In e-beam targets a total rho r of 5 to 10 g/cm^2 can be obtained without pulse shaping; the problem here is one of achieving high enough temperatures to ignite the DT. (MOW)

6163 (SAND-75-5441) TWO-DIMENSIONAL ION EFFECTS IN RELATIVISTIC DIODES. Poukey, J. W. (Sandia Labs., Albuquerque, N. Mex. (USA)). 1975. 15p. (CONF-750539-1). Dep. NTIS $4.00.

From 13th symposium on electron, ion, and photon beam technology; Colorado Springs, Colorado, USA (21 May 1975).

In relativistic diodes, ions are emitted from the anode plasma. The effects and properties of these ions are studied via a two-dimensional particle simulation code. The space charge of these ions enhances the electron emission, and this additional current (including that of the ions, themselves) aids in obtaining super-pinched electron beams for use in pellet fusion studies. (auth)

6164 LASER FUSION: AN ENERGY OPTION, BUT WEAPONS SIMULATION IS FIRST. Gillette, R. Science; 188: No. 4183, 30-34(4 Apr 1975).

A brief review of laser fusion work in the U. S. and the politics surrounding it are discussed. Some of the funding aspects and the use of lasers for weapons simulation are described. (MOW)

6165 MAXIMUM ELECTRON TEMPERATURE AND DENSITY FOR AN ARGON PLASMA CREATED IN A CONVENTIONAL SHOCK TUBE. Pinegre, M.; Valentin, P. (CEA Centre d'Etudes de Vaujours, 93- Sevran (France); Rouen Univ., 76- Mont-Saint-Aignan (France). Lab. de Thermodynamique). Compt. Rend., Ser. A, B; 279: No. 19, 495–498(4 Nov 1974). (In French).

Measured values for the electron temperature and density of an argon plasma created by a strong shock wave are compared with the values calculated after the shock front celerity.

Plasma Stability

6166 (CEA-N-1749) PARAMETRIC INSTABILITIES IN INHOMOGENEOUS PLASMAS. Babonneau, D. (CEA Centre d'Etudes de Limeil, 94 - Villeneuve-Saint-Georges (France)). 26 Jun 1974. 40p. (In French). INIS.

Absolute instabilities are defined against convective instabilities. A synthesis is given, under certain conditions, for the effects of the boundaries or/and the inhomogeneity of the medium on the characteristics of the parametric decay instabilities induced during the interaction between the electromagnetic wave and the plasma. The instabilities which are examined are: plasmon-phonon instabilities (acoustic-ionic); plasmon-plasmon instabilities (Rayleigh); phonon-phonon instabilities (Brillouin); and photon-plasmon instabilities (Raman). (FR)

6167 (CONF-720961–14) PARAMETRIC INSTABILITIES AND ANOMALOUS ABSORPTION AND HEATING OF PLASMAS. Porkolab, M. (Princeton Univ., N. J. (USA). Plasma Physics Lab.). 1972. 8p. Dep. NTIS $4.00.

From symposium on plasma heating and injection; Varenna, Italy (21 Sep 1972).

The linear theory of parametric instabilities is reviewed. The general dispersion relation is derived from the Vlasov equation. The dispersion relation is analyzed in terms of the linear dielectric function and its derivatives. The thresholds and growth rates for the decay instability, the purely growing mode, and the kinetic instability are obtained. The analysis is applied to discuss some specific modes, such as the interaction of electron plasma waves, and the ion acoustic waves, the upper hybrid and the lower hybrid modes, Bernstein waves and ion acoustic waves, and the decay of the whistler wave and the lower hybrid wave. Some numerical results are presented. In RF heating experiments the possibility of parametric instabilities must be recognized. The experimental evidence for the occurrence of parametric instabilities and associated anomalous absorption and/or heating are surveyed. The experiments performed in the past few years can be divided according to geometry as follows: (1) Excitation by grids (including probes and capacitor plates) (2) Cavity excitation (3) Microwave irradiation from waveguides. The advantages and disadvantages of these techniques are compared by discussing specific laboratory experiments. The evidence of anomalous absorption and heating, as being due to parametric instabilities is discussed. (auth)

6168 (CONF-720961-15) NONLINEAR THEORY FOR THE PARAMETRIC INSTABILITY WITH COMPARABLE ELECTRON AND ION TEMPERATURES. Oberman, C. (Princeton Univ., N. J. (USA)). 1972. 9p. Dep. NTIS $4.00.

From symposium on plasma heating and injection; Varenna, Italy (21 Sep 1972).

The basic linear theory of the parametric instability driven by a pump $E_0 \sin \omega_0 t$ oscillating near the electron plasma frequency is reviewed. An expression is derived for the temporal nonlinear development of the fluctuation spectrum of the excited waves. For plasma with comparable electron and ion temperatures nonlinear Landau damping of electron plasma waves on ions provides the dominant nonlinearity. The steady state solutions are examined both analytically and numerically in the limit when the spontaneous emission term is small. The characteristics of the plasma wave spectrum agrees well with the general features of ionospheric observations. The enhanced dissipation rate of the pump due to the presence of the fluctuations agrees with laboratory observations. (auth)

6169 (COO–2081-22) NONLINEAR EFFECTS IN MIRROR MACHINES. Aamodt, R. E. (Colorado Univ., Boulder (USA)). Mar 1975. Contract E(11-1)-2081. 12p. Dep. NTIS $4.00.

The state of knowledge of nonlinear effects in conventional mirror machines is reviewed. The review is to be included in an ERDA report summarizing the entire mirror program. (auth)

6170 (COO-2229-7) DENSITY-SPACE POTENTIAL PHASE DIFFERENCE IN A KELVIN–HELMHOLTZ INSTABILITY. Glowienka, J. C.; Jennings, W. C.; Hickok, R. L. (Rensselaer Polytechnic Inst., Troy, N. Y. (USA). Plasma Dynamics Lab.). 1974. Contract AT(11-1)-2229. 8p. (CONF-741079-8). Dep. NTIS $4.00.

From 16th annual meeting of the plasma physics division of the American Physical Society; Albuquerque, New Mexico, USA (28 Oct 1974).

The low-frequency instability found in a hollow cathode discharge in helium was studied using an ion beam probe as a primary diagnostic tool. Three aspects of the instability are discussed: the location and amplitude of the oscillation and its correlation with the shape of the space potential; the phase angle between density and space potential oscillations; and the comparison of the data with three known instability models--Kelvin-Helmholtz, Rayleigh-Taylor, and drift waves-- for mode identification. (MOW)

6171 (IPP-1/149) ON THE STABILITY OF HIGH-β, HELICALLY SYMMETRIC HYDROMAGNETIC EQUILIBRIA WITH DECREASING PRESSURE PROFILE. Correa, D. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F. R. Germany)). Sep 1974. 29p. INIS.

The influence of the geometrical parameters of helically symmetric ideal magnetohydrodynamic equilibria on the plasma β is investigated. For the calculations, it is assumed that the electric current density vanishes on the magnetic axis. Furthermore, only equilibria which satisfy stability criteria in the neighbourhood of the magnetic axis are considered. The plasma β, here defined as β on the magnetic axis, is estimated assuming that the plasma radius is much smaller than the helical wavelength and that the pressure vanishes on the separatrix. Thus, β depends on the geometrical parameters of the equilibrium and on the steepness of the pressure profile, which is limited by the stability criteria. Configurations having elliptical cross-sections with their major axis along the binormal to the magnetic axis and being slightly D-shaped appear to be favorable for stability and high β values. (auth)

6172 (IPP-6/131) ENERGY PRINCIPLE FOR 2-d RESISTIVE INSTABILITIES. Tasso, H. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F. R. Germany)). Mar 1975. 10p. Dep. NTIS (U. S. Sales Only) $4.00.

An energy principle for 2-d resistive instabilities was found. It leads to a necessary and sufficient condition for stability allowing the use of test functions. One simple consequence is that the current density in a plasma with arbitrary cross section should not increase to the outside. Otherwise the plasma would be unstable against resistive instabilities. (auth)

6173 (MATT-1119) COUPLING TO FAST MHD EIGENMODES IN A TOROIDAL CAVITY. Paoloni, F. J. (Princeton Univ., N. J. (USA). Plasma Physics Lab.). May 1975. Contract AT(11-1)-3073. 31p. Dep. NTIS $4.75.

The coupling to fast MHD waves in toroidal-like geometry is calculated when eigenmodes exist in the plasma. The torus is considered to be a resonant cavity into which energy is coupled by a half turn loop. The cavity Q is calculated for the minority heating process, for cyclotron harmonic damping, electron transit-time magnetic pumping, wall loading, and Coulomb collisional damping. The problem of sustaining the eigenmode as the plasma conditions change with time is also discussed. One method that seems to be practical is a feedback scheme that varies the plasma major radius by a small amount as the conditions change. (auth)

6174 (MATT-1130) THRESHOLDS OF PARAMETRIC INSTABILITIES NEAR THE LOWER HYBRID FREQUENCY. Berger, R. L.; Perkins, F. W. (Princeton Univ., N. J. (USA). Plasma Physics Lab.). Jun 1975. Contract AT(11-1)-3073. 22p. Dep. NTIS $4.25.

Resonant decay instabilities of a pump wave with frequency omega$_0$ near the lower-hybrid frequency omega/sub LH/ are analyzed with respect to the wavenumber k of the decay waves and the ratio omega$_0$/omega/sub LH/ to determine the decay process with the minimum threshold. It was found that the lowest thresholds are for decay into an electron plasma (lower hybrid) wave plus either a backward ion-cyclotron wave, an ion Bernstein wave, or a low frequency sound wave. For omega$_0$ less than (2omega/sub LH/)/sup ½/, it was found that these decay processes can occur and have faster growth than ion quasimodes provided the drift velocity (cE_0/B_0) is much less than the sound speed. In many cases of interest, electromagnetic corrections to the lower-hybrid wave rule out decay into all but short wavelength (k rho/sub i/ greater than 1) waves. The experimental results are consistent with the linear theory of parametric instabilities in a homogeneous plasma. (auth)

6175 (TID-26817) RADIATION COUPLING OF BERNSTEIN MODES IN DENSE LOSS-CONE LIKE PLASMAS. Progress Report. Hoffman, J. (Colorado Univ., Boulder (USA)). Jul 1974. Contract AT(11-1)-2081. 30p. Dep. NTIS $4.50.

The existence of modes with partial transverse polarization at values of kv/sub perpendicular to//OMEGA/sub e/ greater than 1 was demonstrated. These modes form closed loops in space with the Bernstein modes. The stability of the system has been investigated and regions in space as well as regions in k-space have been shown to be unstable. Growth rates as high as 10^{-1} OMEGA/sub e/ have been ascertained. The omega approximately 0 instability has been shown to have approximately the same instability region as was shown by Dory et al. for the longitudinal case. Only preliminary computer work has been completed on this problem. More work is necessary to map out completely the regions of instability and to compute growth rates for more parameter ranges. (auth)

6176 (UCCND-CSD-INF-21) PRELIMINARY DESCRIPTION OF THE LINEAR AND NONLINEAR IDEAL MHD CODES. Wooten, J. W.; Hicks, H. R. (Oak Ridge National Lab., Tenn. (USA)). May 1975. Contract W-7405-eng-26. 96p. Dep. NTIS $8.00.

The 2 dimensional linear and 3 dimensional nonlinear ideal MHD codes recently written at ORNL are described. Emphasis is placed on the programming style chosen to facilitate rapid code development. Some preliminary results are given for the linear growth and subsequent non-linear evolution of a plasma filling a rectangular cylinder with conducting walls and periodic boundary conditions at the ends of the cylinder. Plans exist for modifying the geometry to a torus of general minor cross section and for including non-ideal terms and a vacuum region. (auth)

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Refer also to abstract 8382.

6177 (BDX-613-1325) SORTING AND HANDLING LASER TARGETS. Kuehnle, J. H. (Bendix Corp., Kansas City, Mo. (USA)). May 1975. Contract AT(29-1)-613. 19p. Dep. NTIS $4.00.

Techniques have been developed for separating round, hollow microspheres having uniform wall thickness from bulk quantities of glass and metal microballoons. The process is capable of yielding small quantities of thin-walled (1 mu m), closely-sized microspheres, in the diameter range of 20 to 250 mu m. The air jet sieving and microradiographic techniques employed are described. (auth)

6178 (BNL-19850) USE OF Li(d,n) NEUTRONS FOR SIMULATION OF RADIATION EFFECTS IN FUSION REACTORS. Goland, A. N.; Snead, C. L. Jr.; Parkin, D. M.; Theus, R. B. (Brookhaven National Lab., Upton, N. Y. (USA); Los Alamos Scientific Lab., N. Mex. (USA); Naval Research Lab., Washington, D. C. (USA)). 1975. 5p. (CONF-750335-27). Dep. NTIS $4.00.

From particle accelerator conference; Washington, District of Columbia, USA (12 Mar 1975).

It is shown that the neutron spectrum from high-energy deuteron bombardment of a thick Li target is suitable for simulation of radiation effects in a fusion reactor. Neutron spectra from 15, 20, 25, 30 and 35-MeV deuterons incident, respectively, on a 2-cm thick Li target are reported. For these spectra, a recently-developed computer code was used to evaluate damage-energy cross sections, primary recoil energy distributions, and spectrum-averaged reaction cross sections in several metals. The results indicate that a (d,n) source can simulate the energy dependence of the recoil spectra, and the rate of helium production anticipated in a real fusion reactor. (auth)

6179 (BNWL-tr-140) ASPECTS OF ENERGY SUPPLY FUSION REACTORS. Buende, R.; Daenner, W.; Hofer, W.; Huels, M.; Poehlchen, R.; Soell, M.; Taglauer, E.; Weichsel-gartner, H. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muehchen (F. R. Germany)) 25 Apr 1975. Translation of IPP-VI-1. 87p. Dep. NTIS $7.50.

Two aspects of energy production with fusion reactors are treated: the fuel supply and the radiological impact on the environment. The specific costs for the fuels deuterium and lithium in relation to the energy released are extremely low, being only about $1/_{100}$ of the fuel cycle costs of fast breeder reactors, and so extracting lithium from sea water is an economic proposition. For this reason the energy reserves of the deuterium-tritium reactor are sufficient for 10^5 to 10^6 years, and deuterium and lithium are available to almost every country in the world. The radioactive inventory of the fusion reactor consists only of the tritium in the fuel cycle and the structure material activated in the neutron flux. The radioactivity to which the environment is subjected owing to the release of tritium can be kept below the permissible values. The activities of the structure material are solid-state activities, which are easy to handle compared with the radioactive inventory of a fission reactor. As far as the effects of emergencies are concerned, it is particularly important to note that spontaneous power excursion of the fusion reactor is impossible, and that the after-heat is at least one order of magnitude smaller than in fission reactors. From the present state of the art it is obvious that the fusion reactor affords distinct advantages over the fission reactor. (auth)

6180 (CLM-R-141) TIME CONSTANT FOR MAGNETIC FIELD DIFFUSION INTO A HOLLOW CYLINDRICAL CONDUCTOR. Khalaf-Allah, K. (UKAEA Research Group, Abingdon, Culham Lab.). Nov 1974. 11p. Dep. NTIS (US Sales Only) $4.00.

The equation governing the time constant for magnetic field diffusion into a hollow cylindrical conductor is derived for a field which is either parallel or perpendicular to the conductor. If the time constant is written as $T = \mu/q^2\rho$, then for both field orientations the equation is: $J_0(qa)\,Y_2(qb) - J_2(qb)\,Y_0(qa) = 0$, where a and b are the outside and inside conductor radii respectively. The exact value of q is compared with: (1) The value given by the thin-shell approximation ($q^2 = 2/bt$, t is the conductor wall thickness). The error in using this value is less than 10% in the range $0.6 < b/a < 1$. (2) The value given by the solid conductor approximation ($q = 2.405/a$). The error is less than 10% in the range $b/a < 0.5$. (auth)

6181 (CONF-750606-2) COMPUTATION OF TRANSPORT AND NEUTRAL BEAM INJECTION IN TOKAMAKS. Hogan, J. T.; Howe, H. C.; Fowler, R. H. (Oak Ridge National Lab., Tenn. (USA)). 1974. 4p. Dep. NTIS $4.00.

From 7th conference on numerical simulation of plasmas; New York, New York, USA (2 Jun 1975).

This paper presents a description of a simulation code which is being used to study tokamak experiments. The emphasis in the model is on computational simplicity, so that one may attain some understanding of the interaction between the major plasma and atomic physics processes in a real experiment. The code is modular, so that more sophisticated treatments of any constituent process may be readily adapted. While other papers at this meeting will deal with basic plasma physical processes, we will proceed with semi-empirical models where necessary. The code solves one-dimensional, time dependent fluid equations for protons, electrons, and impurity ion species and the electromagnetic fields. The balance of neutral gas is treated by solving a 1-D space, 2-D velocity neutral kinetic equation. Fast injected ions are treated with a 1-D space, 2-D velocity time-dependent Fokker-Planck equation. The code incorporates rate equations for the stripping of carbon and oxygen impurities, and corona equilibria for impurities with atomic charge up to 28. The beam ion deposition profile is calculated by averaging birth distributions over the fast ion trajectories in the toroidal and poloidal fields. (auth)

6182 (CONF-750607-11) HEAT TRANSFER ANALYSIS OF A FIRST WALL RADIATION SHIELD FOR A FUSION REACTOR. Patten, J.; Coultas, T. (Argonne National Lab., Ill. (USA)). [nd]. 28p. Dep. NTIS $4.00.

From American Nuclear Society meeting; New Orleans, Louisiana, USA (8 Jun 1975).

The analysis is based on a graphite liner interposed between the plasma and the first wall (vacuum wall). A radiation boundary condition is assumed at the rear face or the shield, with no other mode of heat transfer at that boundary being considered. The first wall is assumed to be composed of stainless steel and is held at a constant temperature of 540°C. Neutronics calculations, using ANISN, were performed for the base case of 1 MW/m² surface flux. Volumetric heat generation rates were then scaled as a linear function of wall loading. A transient finite difference scheme was used which accounts for heat generation, heat loss by convection, conduction and/or radiation at each node, and physical property variations with temperature. Simplified one-dimensional geometry was assumed throughout. The interposition of the liner significantly altered both the heat transfer environment and neutron flux at the first wall. The reduction in neutron density requires the addition of beryllium as a neutron multiplier to attain a tritium breeding ratio of one. Since the addition of the liner alone significantly altered the neutronics, the incorporation of small amounts of internal cooling will not further aggravate the problem. The particular design investigated allowed molten tin (melting point 230°C, boiling point 2270°C) to flow parallel to the toroidal circumference. As an alternative, LiF-BeF_2 (flibe) was used as a coolant. The addition of coolants does not significantly alter the neutronic performance of the liner. However, the internally cooled concept

allows neutron fluxes as high as 20 MW/m^2, at the front face of the first wall liner, to be accommodated without compromising the structural integrity of the vacuum wall. In addition the use of low Z graphite reduces the interaction of the wall materials and the plasma. (auth)

6183 (COO-2218-28) REACTIVITIES FOR TWO-COMPONENT FUSION CALCULATIONS. Miley, G. H.; Towner, H. H. (Illinois Univ., Urbana (USA)). 1975. 6p. (CONF-750303-51). Dep. NTIS $4.00.

From proceedings on nuclear cross section and technique; Washington, District of Columbia, USA (3 Mar 1975).

Tables and graphs of fusion reactivities (broken bracket sigma v broken bracket) are readily available for fusion in thermalized (Maxwellian) plasma using common fuels. However, plans to construct the Two-Component Torus (TCT) have created a need for reactivities to characterize fusion via high-energy beams interacting with low-temperature target plasmas. Such reactivities are derived for a variety of fuels including D yields T, D yields ^{3}He, D yields D, T yields T, T yields ^{3}He, and p yields ^{11}B. Some examples of the use of these reactivities in two-component calculations are also described. (auth)

6184 (COO-2218-32) EFFECT OF RADIATION LOSSES ON FUSION ENERGY BALANCES. Miley, G. H.; Chu, T. C. (Illinois Univ., Urbana (USA)). 1974. 5p. (CONF-750607-5). Dep. NTIS $4.00.

From American Nuclear Society meeting; New Orleans, Louisiana, USA (8 Jun 1975).

A series of graphs are derived that can be used to estimate the effect of cyclotron emission on a variety of advanced fuels. This provides a convenient method for quickly carrying out survey-type calculations. The utility of this presentation is that the overall plant efficiency can in turn be written as a function of Q/sub R/, the plasma multiplication factor Q/sub p/, and component efficiencies. A typical result is given. (MOW)

6185 (COO-2218-33) PLASMA REQUIREMENTS FOR FUSION–FISSION HYBRIDS. Miley, G. H. (Illinois Univ., Urbana (USA)). 1974. 5p. (CONF-750607-6). Dep. NTIS $4.00.

From American Nuclear Society meeting; New Orleans, Louisiana, USA (8 Jun 1975).

Calculations are given for a hybrid plant having a thermal converter of efficiency n/sub th/, along with a direct converter and injector for the plasma of efficiencies n/sub DC/ and n/sub I/, respectively. An overall efficiency for electrical production is given. (MOW)

6186 (ERDA-tr-17) SYSTEMS ANALYSIS AND DESIGN OF THERMONUCLEAR STATIONS. Papers Delivered at a Joint USSR–USA Seminar, 9–20 December 1974. 1974. Translation of Sistemnyy Analiz i Konstruktsii Termoyadernykh Stantsiy, NIIEFA, Leningrad, 1974. (CONF-741238-). 218p. Dep. NTIS $14.00.

Separate abstracts were prepared for the eleven included papers. (MOW)

For abstracts of individual papers see: 6119 and 6187–6196.

6187 (ERDA-tr-17, pp vp, Paper 1) PLACE OF HYBRID REACTORS IN THE WORLD ENERGY SYSTEM. Golovin, I. N. (Inst. of Atomic Energy, Moscow). 1974. Translation by W. J. Grimes of O Meste Gibridnykh Reaktorov v Energeticheskoy Sisteme Mira.

From joint USSR-USR seminar; Leningrad, USSR (9 Dec 1974).

In systems analysis and design of thermonuclear stations. (Nauchno-Issledovatel'skij Inst. Ehlektrofizicheskoj Apparatury, Leningrad (USSR)).

The prospects for using thermonuclear reactors with magnetic plasma confinement for generating power are reviewed. A cyclic tokamak reactor is considered in particular. The neoclassical approach to controlled fusion is discussed. The use of beam injection for filling along with hybrid reactors is described. (MOW)

6188 (ERDA-tr-17, pp vp, Paper 2) ENGINEERING PROBLEMS RELATED TO THE DESIGN OF A THERMONUCLEAR REACTOR BASED ON THE TOKAMAK. Popov, G. N. (Inst. of Atomic Energy, Moscow); Strelkov, V. S.; Shatalov, G. E.; Glukhikh, V. A.; Mingalev, B. S.; Monoszon, N. A.; Andreev, P. A.; Borishanskii, V. M.; Zhokhov, K. A. 1974. Translated by W. J. Grimes of Nekotorye Inzhenernye Problemy Sozdaniya Termoyadernogo Reaktora na Osnove Tokamaka.

From joint USSR-USR seminar; Leningrad, USSR (9 Dec 1974).

In systems analysis and design of thermonuclear stations. (Nauchno-Issledovatel'skij Inst. Ehlektrofizicheskoj Apparatury, Leningrad (USSR)).

The construction details of a power reactor of the tokamak-type are discussed. An experimental test reactor is described from an engineering viewpoint. Two versions of the reactor were studied: (1) a version with a stronger field and smaller dimensions, in which the possibility of triggering a thermonuclear reaction was studied by means of Joule heating with the discharge current of the plasma, (2) a large-scale version with supplementary plasma heating by means of hf and uhf energy and injection of neutrals. The specifics are given. (MOW)

6189 (ERDA-tr-17, pp vp, Paper 3) CERTAIN PARAMETERS OF THE BLANKET OF A THERMONUCLEAR REACTOR WITH A FISSIONABLE SUBSTANCE. Marin, S. V.; Markovskii, D. V.; Smirnov, L. P.; Shatalov, G. E. (Inst. of Atomic Energy, Moscow). 1974. Translation by W. J. Grimes of Nekotorye Parametry Blanketa Termoyadernogo Reaktora s Delyashchimsya Veshchestvom.

From joint USSR-USR seminar; Leningrad, USSR (9 Dec 1974).

In systems analysis and design of thermonuclear stations. (Nauchno-Issledovatel'skij Inst. Ehlektrofizicheskoj Apparatury, Leningrad (USSR)).

The parameters of a number of simplified systems were studied, containing uranium, lithium, and structural materials. Neutron physics calculations were performed using the Monte Carlo method in the energy range from 0.01 to 14.0 MeV and the P_1 approximation for an energy of 0.0 to 6.0 MeV. The results of the calculations, with norming for a single fusion event, are shown. (MOW)

6190 (ERDA-tr-17, pp vp, Paper 4) CALCULATION OF NEUTRON FLUXES AND ENERGY OUTPUT IN THE BLANKET OF A THERMONUCLEAR REACTOR. Marin, S. V.; Markovskii, D. V.; Shatalov, G. E. (Inst. of Atomic Energy, Moscow). 1974. Translation by W. J. Grimes of Raschet Potokov Neytronov i Energovydeleniy v Blankete Termoyadernogo Reaktora.

From joint USSR-USR seminar; Leningrad, USSR (9 Dec 1974).

In systems analysis and design of thermonuclear stations. (Nauchno-Issledovatel'skij Inst. Ehlektrofizicheskoj Apparatury, Leningrad (USSR)).

One of the most important problems associated with the design of thermonuclear reactors is the calculation of the neutron fluxes and energy outputs in the blanket, as well as the protection of the magnets and magnetic windings. The formulation of methods for performing such calculations as they apply to a blanket, which does not contain fissionable material, is discussed. Preliminary results are presented of a computation of the energy outputs in the blanket of the experimental test reactor. (MOW)

6191 (ERDA-tr-17, pp vp, Paper 5) PLANNING PARAMETERS FOR THE ETRT VACUUM SYSTEM. Preliminary Considerations. Vakhrushin, Yu. P.; Izotov, E. N.; Komarov, V. L.; Malyshev, I. F.; Odintsov, V. N.; Saksaganskii, G. L.; Serebrennikov, D. V.; Fefelov, P. A. (Scientific Research Inst. of Electrophysical Apparatus, Leningrad). 1974. Translation by W. J. Grimes of Proektnye Parametry Vakuumnoy Sistem ETRT. Predvaritel'nye Soobrazheniya.

From joint USSR-USR seminar; Leningrad, USSR (9 Dec 1974).

In systems analysis and design of thermonuclear stations. (Nauchno-Issledovatel'skij Inst. Ehlektrofizicheskoj Apparatury, Leningrad (USSR)).

Preliminary considerations relating to the selection of parameters and the layout of the vacuum system for a tokamak experimental thermonuclear reactor vacuum system (ETRT) are discussed. The vacuum systems described are for the reactor channel, injector assembly, for purification devices, for devices for separation of reaction products, for tritium separation devices, for evacuating the jacket of the blanket, for evacuating the connecting lines, and for vacuum thermal insulation of the cryostat of the superconducting magnet units. (MOW)

6192 (ERDA-tr-17, pp vp, Paper 6) DEVICES FOR POWERING THE WINDINGS OF THE ELECTROMAGNETIC SYSTEM OF THE EXPERIMENTAL THERMONUCLEAR REACTOR OF THE "TOKAMAK" TYPE. Monoszon, N. A.; Spevakova, F. M.; Stolov, A. M. (Scientific Research Inst. of Electrophysical Apparatus, Leningrad). 1974. Translation by W. J. Grimes of Ustroystva Pitaniya Obmotok Elektromagnitnoy Sistemy Eksperimental'nogo Termoyadernogo Reaktora Tipa "Tokamak".

From joint USSR-USR seminar; Leningrad, USSR (9 Dec 1974).

In systems analysis and design of thermonuclear stations. (Nauchno-Issledovatel'skij Inst. Ehlektrofizicheskoj Apparatury, Leningrad (USSR)).

In accordance with the classical diagram of the tokamak installation, production of current in a plasma is accomplished by induction, for which purpose an additional winding, the inductor, is used. Two versions for powering the helical electric field are discussed. In one of them, the inductor is used as the primary winding of the inductor transformer tank, in which the energy is stored beforehand which is required for producing a current in the plasma pinch. In the other version, the inductor is the primary winding of a transformer for generating current in the plasma and an external source is connected to this winding. (MOW)

6193 (ERDA-tr-17, pp vp, Paper 7) TRITIUM IN A THERMONUCLEAR POWER REACTOR. Ershov, Z. V.; Basil'ev, V. G.; Evgrafova, D. I.; Kapt'shev, V. K.; Mukhamet-Galeeva, S. Sh. (All-Union Scientific Research Inst. for Inorganic Materials, Moscow). 1974. Translation by W. J. Grimes of Tritiy v Energeticheskom Termoyadernom Reaktore.

From joint USSR-USR seminar; Leningrad, USSR (9 Dec 1974).

In systems analysis and design of thermonuclear stations. (Nauchno-Issledovatel'skij Inst. Ehlektrofizicheskoj Apparatury, Leningrad (USSR)).

Estimates are given for fuel consumption and production for a thermonuclear reactor operating on a D-T mixture in a ratio of 1:1. Multiplication coefficients of neutrons for various blanket media are listed. A schematic diagram of the tritium cycle is shown. Structural materials for a lithium circuit are compared. Tritium permeability and extraction from the system are discussed. (MOW)

6194 (ERDA-tr-17, pp vp, Paper 9) ANALYSIS OF CERTAIN PROBLEMS OF THERMONUCLEAR REACTORS BASED ON A THETA-PINCH WITH A LINER. Baranov, G. A. (Scientific Research Inst. of Electrophysical Apparatus, Leningrad); Glukhikh, V. A.; Zheltov, V. A. 1974. Translation by W. J. Grimes of Analiz Nekotorykh Problem Termoyadernogo Reaktora na Osnove Theta-Pincha s Laynerom.

From joint USSR-USR seminar; Leningrad, USSR (9 Dec 1974).

In systems analysis and design of thermonuclear stations. (Nauchno-Issledovatel'skij Inst. Ehlektrofizicheskoj Apparatury, Leningrad (USSR)).

The development of a theta-pinch reactor with liner is discussed. A serious approach requires the performance of systems analysis for the purpose of selecting the theoretical solutions for the individual assemblies and determining the possibility of control as a whole. The problems which arise in sequential analysis of a reactor are discussed. (MOW)

6195 (ERDA-tr-17, pp vp, Paper 10) POSSIBILITY OF DESIGNING A THERMONUCLEAR REACTOR WITH A DENSE PLASMA, CONFINED BY A CORRUGATED MAGNETIC FIELD. Budker, G. I.; Kruglyakov, E. P.; Mirnov, V. V.; Pyutov, D. D. (Inst. of Nuclear Physics, Novosibirsk, USSR). 1974. Translation of O Vozmozhnosti Sozdaniya Termoyadernogo Reaktora s Plotnoy Plazmoy, Uderzhiyaemoy Gofrirovannym Magnitiym Polem.

From joint USSR-USR seminar; Leningrad, USSR (9 Dec 1974).

In systems analysis and design of thermonuclear stations. (Nauchno-Issledovatel'skij Inst. Ehlektrofizicheskoj Apparatury, Leningrad (USSR)).

Longitudinal and transverse confinement in a corrugated magnetic system is described. Plasma heating by relativistic electron beams is mentioned. A hypothetical thermonuclear reactor using these concepts is briefly described. (MOW)

6196 (ERDA-tr-17, pp vp, Paper 11) "JUPITER" THERMONUCLEAR REACTOR BASED ON CONFINEMENT OF PLASMA BY ELECTRICAL AND MAGNETIC FIELDS. Lavrent'ev, O. A.; Kalmykov, A. A.; Georgievskii, A. V.; Ziser, V. E.; Yuferov, V. B. (Physical-Technical Inst., Kharkov). 1974. Translation by W. J. Grimes of Termoyadernyy Reaktor "Yupiter" na Osnove Uderzhivaniya Plazmy Elektricheskimi i Magnitnymi Polyami.

From joint USSR-USR seminar; Leningrad, USSR (9 Dec 1974).

In systems analysis and design of thermonuclear stations. (Nauchno-Issledovatel'skij Inst. Ehlektrofizicheskoj Apparatury, Leningrad (USSR)).

The design of an electromagnetic trap which ensures thermal insulation of the high-temperature plasma is described. The magnetic field with acute-angle geometry was formed by conductors with current arranged so that it traveled in mutually opposite directions in adjacent wires. The magnetic gaps, connecting the internal volume of the trap with the surrounding space, were covered on the outside with negatively charged electrons, preventing the escape of the electrons from the trap. The electrons injected into the trap accumulate between the magnetic surfaces, forming a negative space charge and a potential well for the ions. The ions are guided and confined in this potential well. Parameters of the reactor are given. (MOW)

6197 (IPPJ-195) SOME ASPECTS ON TOKAMAKS WITH NON CIRCULAR CROSS SECTION. Jacquinot, J. (Nagoya Univ. (Japan). Inst. of Plasma Physics). Aug 1974. 20p. INIS.

The main efforts in future Tokamaks experiments appears to be aimed towards three main objectives; (i) Investigation of scaling laws in the collisionless regime. (ii) Reduction of the impurity content. (iii) Optimization of the plasma parameters for better and more economical performance. In most laboratories large programs are presently being organized to tackle these goals. Divertors and actions on the friction term between impurities and light ions are the best guide lines for objective ii). Objectives i) and iii) are discussed with the 4 free parameters of Tokamaks: Magnetic field, size, aspect ratio and shape. With special emphasis on the importance of the shape, some of the basic properties of Tokamaks are reviewed. (auth)

6198 (JAERI-M-5849) THE MULTI-HOLE VACUUM WALL OF A FUSION DEVICE TO REDUCE THE EFFECTIVE SPUTTERING YIELD. Yoshikawa, M. (Japan Atomic Energy Research Inst., Tokyo). Sep 1974. 20p. (In Japanese). INIS.

The vacuum chamber wall of multi-hole structure provides a possibility of reducing the effective sputtering yield in a fusion device by adsorbing in the holes such atoms produced by the plasma-particle bombardment. The effective sputtering yield is evaluated quantitatively for the sputtered metal atoms for which the sticking probability in the holes is close to unity. The sputtering yield decreases rapidly by a factor of 5–6 to 20–30% of the sputtering yield for normal incidence, as the depth-to-width ratio of holes increases from 0 to 1. Beyond the latter ratio, it reduces no longer. (auth)

6199 (JAERI-M-5855) EVALUATION OF GAS PRODUCTION IN THE MOLYBDENUM STRUCTURES OF A FUSION REACTOR. Iwai, K.; Seki, Y. (Japan Atomic Energy Research Inst., Tokyo). Sep 1974. 31p. (In Japanese). INIS.

The cross sections of gas-producing reactions such as (n,α) and (n,p) for molybdenum isotopes were surveyed and compiled. Multi-group cross section tables for the reactions were thus prepared. Hydrogen and helium production rates in the molybdenum structures of the fusion reactor being designed in JAERI were evaluated. The neutron transport calculations were evaluated. The neutron transport calculations were made by ANISN, using the cross section tables and the cross section set from ENDF/B-III. The effects of gas production reactions on the tritium breeding ratio, the neutron energy spectrum in the first wall protection structure, and leakage neutron spectrum from the blanket were also studied. (auth)

6200 (LA-5336(Vol. 2)) ENGINEERING DESIGN STUDY OF A REFERENCE THETA-PINCH REACTOR (RTPR): ENVIRONMENTAL IMPACT STUDY. Draley, J. E.; Krakowski, R. A.; Coultas, T. A.; Maroni, V. A. (Nucleo de Estudos e Pesquisas Cientificas do Rio de Janeiro (Brazil); Argonne National Lab., Ill. (USA)). Mar 1975. Contract W-7405-ENG-36. 73p. (ANL-8019). Dep. NTIS $5.45.

The recently completed engineering design study for the Reference Theta-Pinch Reactor (RTPR) has allowed an assessment of the potential environmental impact of an RTPR power plant to be made. During normal operation of the plant, tritium is expected to be released at a rate of 6 Ci/day, an amount that would lead to low maximum doses (0.06 to 0.8 mrem/yr, depending on site and cooling options). These doses, and the anticipated integrated population doses, are considerably less than doses now considered acceptable. Problems related to (i) the required commitment of some natural resources (e.g., beryllium and niobium), (ii) the disposition of activated structural materials and other radioactive waste (76,700 kg/yr or 12 GCi/yr at shutdown) for a five-year niobium component lifetime, and (iii) land despoilment are substantial but do not appear to compromise the viability of RTPR's as a useful power source. Consideration of the occurrence of severe accidents (e.g., liquid-metal fires) and other unusual incidents indicate that their effects will be contained within the plant, but that they may be costly. Radiation doses resulting from accidental release of the operating tritium inventory during a liquid-metal fire would probably be below the level now permitted for fission plants. (auth)

6201 (LA-tr-75-3) POSSIBILITY OF BUILDING A THERMONUCLEAR REACTOR WITH A DENSE PLASMA CONTAINED BY A CRIMPED MAGNETIC FIELD. Budker, G. I.; Kruglyakov, E. P.; Mirnov, V. V.; Ryutov, D. D. (AN SSSR, Novosibirsk. Inst. Yadernoj Fiziki). Jan 1975. Translation by H. J. Dahlby of O Vozmoshnosti Sozdaniia Termoiadernogo Reaktora c Plotnoi Underzhivaemoi Gofritovannym Magnitnym Polem. (CONF-741238-1). 18p. Dep. NTIS $4.00.

From joint USSR-USR seminar; Leningrad, USSR (9 Dec 1974).

A straight tube plasma device with a longitudinal magnetic field is proposed. A plasma blob will be created at the initial moment of time in the middle part of the apparatus, after which the plasma will be freely spread to the ends of the tube. The crimped magnetic systems consists of a set of mirrors, connected by the ends. In each mirror there are trapped particles accomplishing a finite movement between the mirrors. Containment parameters of the device are presented. (MOW)

6202 (LA-UR-75-14) OPTICAL QUALITY STUDY OF THE L.A.S.L. CO_2 LASER AMPLIFIER SYSTEM. Goldstein, J. C. (Los Alamos Scientific Lab., N. Mex. (USA)). [nd]. Contract W-7405-ENG-36. 5p. (CONF-750520-1). Dep. NTIS $4.00.

From IEEE Optical Society of American conference on laser engineering and applications; Washington, District of Columbia, USA (28 May 1975).

The optical quality of the output pulse produced by the LASL CO_2 laser amplifier system was studied by calculating the time resolved intensity distribution obtained at the focus of a perfect lens. (auth)

6203 (LA-UR-75-511) VAPOR PHASE COATINGS OF METALS AND ORGANICS FOR LASER FUSION TARGET APPLICATIONS. Simonsic, G. A.; Powell, B. W. (Los Alamos Scientific Lab., N. Mex. (USA)). [nd]. Contract W-7405-ENG-36. 29p. (CONF-750434-3). Dep. NTIS $4.50.

From 18th annual conference of the Society of Vacuum Coaters; Key Biscayne, Florida, USA (7 Apr 1975).

Techniques for applying a variety of metal and organic coatings to 50- to 500 mu m diameter glass micro-balloons are discussed. Coating thicknesses vary from 1- to 10 mu m. Physical vapor deposition (PVD), chemical vapor deposition (CVD), and electrolytic and electroless plating are some of the techniques being evaluated for metal deposition. PVD and glow discharge polymerization are being used for the application of organic coatings. (auth)

6204 (LA-UR-75-554) ENERGY STORAGE, COMPRESSION, AND SWITCHING IN A THETA-PINCH FUSION TEST REACTOR. Thomassen, K. I. (Los Alamos Scientific Lab., N. Mex. (USA)). 1974. Contract W-7405-eng-36. 8p. (CONF-741163-1). Dep. NTIS $4.00.

From international conference on energy storage, compression and switching; Asti, Italy (5 Nov 1974).

The new magnetic energy transfer and storage system being developed for the Scyllac Fusion Test Reactor is briefly described. The 488 MJ superconducting storage and switching system is described in particular. The system has 1280 modules of 381 kJ coils, each module driving a 20 cm section of the torus. (MOW)

6205 (MATT-1118) EMPIRICAL SCALING FOR PRESENT OHMIC HEATED TOKAMAKS. Daughney, C. (Princeton Univ., N. J. (USA). Plasma Physics Lab.). Jun 1975. Contract AT(11-1)-3073. 28p. Dep. NTIS $4.50.

Empirical scaling laws are given for the average electron temperature and electron energy confinement time as functions of plasma current, average electron density, effective ion charge, toroidal magnetic field, and major and minor plasma radius. The ohmic heating is classical, and the electron energy transport is anomalous. The present scaling indicates that ohmic-heating becomes ineffective with larger experiments. (auth)

6206 (NP-20380, pp 3.1-3.19) FUSION POWER. Michaelson, W. G.; Piascik, T. M. (Public Service Electric and Gas Co., Newark, NJ). 1974.

In status report: energy resources and technology.

A comprehensive review of the fusion program is given. Some of the topics discussed include the following: (1) total known reserves, (2) reserves presently available at given prices, (3) environmental and safety considerations, (4) research and development program goals include magnetic confinement and laser fusion, (5) funding and industrial participation, and (6) capital and other requirements for commercialization. (MOW)

6207 (ORNL-TM-4920) BEAM FOCUSING BY APERTURE DISPLACEMENT IN MULTIAMPERE ION SOURCES. Stewart, L. D.; Kim, J.; Matsuda, S. (Oak Ridge National Lab., Tenn. (USA)). May 1975. Contract W-7405-eng-26. 19p. Dep. NTIS $4.00.

Results are given of an experimental study of beam focusing by aperture displacement (DELTA x) in duoPIGatron ion sources. Measurements with a single aperture, accel-decel electrode geometry show that the beam deflection angle is linear with DELTA x/z for the round aperture and with DELTA x/z^{*2} for the slit aperture where z and z^* are respectively the extraction gap distance and the effective gap distance. Applying the result of the single aperture study to the multiaperture, duoPIGatron sources, it was possible to increase the neutral beam injection power to the ORMAK plasma by approximately 40 percent. Also presented are discussion and comparison of other work on the effect of aperture displacement on beam deflection. (auth)

6208 (ORO-4513-2) THEORY OF HIGH TEMPERATURE PLASMAS. [Progress Report]. Davidson, R. C. (Maryland Univ., College Park (USA)). 1975. Contract AT(40-1)-4513. 12p. Dep. NTIS $4.00.

A listing of published research concerning this contract is given. In addition, an extensive list of associated reference work is also given. (MOW)

6209 (SAND-75-5122) VACUUM PUMPING CONSIDERATIONS FOR ELECTRON BEAM FUSION REACTORS. Hunter, T. O. (Sandia Labs.; Albuquerque, N. Mex. (USA)). 1975. 5p. (CONF-750624-3). Dep. NTIS $4.00.

From American Nuclear Society meeting; New Orleans, Louisiana, USA (8 Jun 1975).

Inertially confined fusion reactors have vacuum requirements which differ substantially from alternative reactor concepts. Between pellet bursts, the vacuum systems for electron-beam and laser initiated fusion reactors must reestablish the pressure and particle densities necessary for beam focusing. This paper develops the required pumping system capacities considering steady state and pulsed gas loads, determines the conditions for electron beam reactor geometry necessary to establish spatial pressure gradients for diode operation, and compares such requirements with conventional vacuum technology. (auth)

6210 (UCID-16736) COMMITTEE REPORT: LLL REEVALUATION OF THE SIMPLE MIRROR FOR A FUSION REACTOR. Moir, R. W.; Baldwin, D. E.; Carlson, G. A.; Fowler, T. K.; Logan, B. G.; Lieberman, M. A.; Pearlstein, L. D.; Simonen, T. T. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 18 Apr 1975. Contract W-7504-eng-48. 65p. Dep. NTIS $6.25.

In response to potential cost savings, a re-evaluation is made of the prospects for using the simple mirror configuration in a fusion reactor. Because of flute instability problems, this configuration was largely dropped in early mirror research in favor of the magnetic-quadrupole-well configuration, a more complex and costly arrangement but one not bothered by flute-mode instability. Here, both line-tying and feedback stabilization of simple-mirror flute instability are examined. Based on both theoretical considerations and experimental evidence, line tying was found to require so much exterior cold plasma that fusion energy release was greatly reduced due to a large loss of energy from the hot ions to the cold electrons. Line tying showed promise, however, for the two-component mode of simple-mirror operation. Feedback stabilization, although not yet defined in enough detail to assess its practicality, may work and deserves further investigation. (auth)

6211 (UCID-16800) SCALING OF A TRUSS SUPPORT STRUCTURE FOR YIN YANG COILS. Schwer, C. J. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 20 May 1975. Contract W-7405-eng-48. 21p. Dep. NTIS $4.25.

In general, a C-clamp coil structure is usually proposed in feasibility studies to provide support of the magnetic forces developed in Yin Yang coils. The purpose of this paper is to demonstrate that the more efficient truss structure can provide the same function of support as a C-clamp coil structure at a smaller structural cost. (auth)

6212 (UCRL-51778) REMOTE OPERATIONS IN A FUSION ENGINEERING RESEARCH FACILITY (FERF). Doggett, J. N. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 14 Mar 1975. Contract W-7405-Eng-48. 20p. Dep. NTIS $4.00.

The proposed Fusion Engineering Research Facility (FERF) has been designed for the test and evaluation of materials that will be exposed to the hostile radiation environment created by fusion reactors. Because the FERF itself must create a very hostile radiation environment, extensive remote handling procedures will be required as part of its routine operations as well as for both scheduled and unscheduled maintenance. This report analyzes the remote-handling implications of a vertical- rather than horizontal-orientation of the FERF magnet, describes the specific remote-handling facilities of the proposed FERF installation and compares the FERF remote-handling system with several other existing and proposed facilities. (auth)

6213 (UCRL-74626) PULSE CHARACTERIZATION FOR THE LONG PATH LASER AT LLL. Coleman, L. W.; Swain, J. E.; Rainer, F.; Saroyan, R. A. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 2 Apr 1973. 57p. Dep. NTIS $6.00.

Characteristics of the pulse produced by the Laboratory's Long Path Laser are reported. The pulse was studied at the output of the oscillator, the rod-amplifier chain, and the multi-pass disk amplifier. Diagnostic instruments included a Laboratory-built 10-psec resolution streak camera and a high resolution 3.4-m Ebert spectrograph. The oscillator and rod-amplifier chain outputs show strong, regular 28 psec intensity modulation produced by mode beating in the oscillator. The spectrum at each position is a regular series of lines whose wavelength separations correspond to the temporal structure observed with the streak camera. The

modulation is smoothed by the disk amplifier and the spectrum is distorted and broadened. Time-resolved spectra were recorded at the output of the rod chain and the disk amplifier. Pronounced spectral differences observed at these two positions correspond to the intensity modulation smoothing observed with the streak camera after nine passes through the disk amplifier. (auth)

6214 (UCRL-76702) OPTICAL PULSE COMPRESSION. Glass, A. J. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 16 Apr 1975. 7p. (CONF-741113-13). Dep. NTIS $4.00.

From international conference on energy storage, compression and switching; Torino, Italy (5 Nov 1974).

The interest in using large lasers to achieve a very short and intense pulse for generating fusion plasma has provided a strong impetus to reexamine the possibilities of optical pulse compression at high energy. Pulse compression allows one to generate pulses of long duration (minimizing damage problems) and subsequently compress optical pulses to achieve the short pulse duration required for specific applications. The ideal device for carrying out this program has not been developed. Of the two approaches considered, the Gires–Tournois approach is limited by the fact that the bandwidth and compression are intimately related, so that the group delay dispersion times the square of the bandwidth is about unity for all simple Gires–Tournois interferometers. The Treacy grating pair does not suffer from this limitation, but is inefficient because diffraction generally occurs in several orders and is limited by the problem of optical damage to the grating surfaces themselves. Nonlinear and parametric processes were explored. Some pulse compression was achieved by these techniques; however, they are generally difficult to control and are not very efficient. (auth)

6215 SOME CONSIDERATIONS ON LARGE-SIZED CATALYTIC PUMPS FOR NUCLEAR FUSION APPARATUS. Murakami, Y. (Tokyo Shibaura Electric Co., Ltd.); Kurisaki, T.; Ishibe, Y.; Okamoto, K. Jap. J. Appl. Phys.; No. Suppl. 2, 89-92(1974).

From 6th international vacuum congress; Kyoto, Japan (25 Mar 1974). See CONF-740353–.

Studies were made of the problems encountered in the development of a large-sized catalytic pump for the pumping of hydrogen in nuclear fusion apparatus. An experimental pump having a speed of about 5000 liter/sec is assumed to use at partial pressures between 10^{-7} and 10^{-5} torr. The influence of water vapor on the atomization of hydrogen at the rhenium filament is one of the problems, and is discussed from the structural point of view. The lifetime of the cuprous oxide layer is another important problem. A convenient method of oxidation of copper plates by atomic oxygen produced at an incandescent rhenium filament is proposed for the generation and regeneration of the oxide. The optimum temperatures of the cuprous oxide layer are also determined for the rapid desorption of water vapor from the oxide and for the effective reaction with hydrogen atoms. (auth)

6216 VACUUM CHAMBER OF A TOKAMAK PLASMA EXPERIMENT (TFR). Sledziewski, Z.; Huguet, M.; Rebut, P. H.; Torossian, A. (EURATOM–CEA, Fontenay-aux-Roses, France). Jap. J. Appl. Phys.; No. Suppl. 2, 217-220(1974).

From 6th international vacuum congress; Kyoto, Japan (25 Mar 1974). See CONF-740353–.

The magnetic confinement of hot plasmas needs high quality vacuum chambers. The bombardment of the walls by particles (ions, electrons, fast atoms, photons, neutrons) must not involve a large flux of secondary emission products. This report describes the realization of a vacuum chamber needful for a toroidal plasma confinement experiment of Tokamak type (TFR). The geometric characteristics of the torus are: major radius 0.98 m, minor radius 0.20 m, volume of the chamber and observation ports: 1.5 m^3, total surface: 35 m^2. The vacuum vessel is made of a series of bellows of inconel × 750, 0.5 mm thick; it is bakable up to 450°C. The assembling of each toroidal section with the observation ports is obtained by electron-bombardment welding. The pumping circuit consists of a primary pump and two turbomolecular pumps in series (600 l/s and 70 l/s). Two 0.5 m^2 titanium pumps, cooled at liquid nitrogen temperature, are also used in parallel with the turbomolecular pumps in order to increase the pumping speed between two plasma discharges. The base pressure obtained after baking the chamber itself at 420°C and the observation sections at 200°C is 5×10^{-10} torr. The mean outgassing rate of the walls is then 2×10^{-13} torr l/s · cm^2. (auth)

6217 VACUUM PROBLEMS ASSOCIATED WITH THE CONCEPTIONAL DESIGN OF TOKAMAK FUSION REACTORS. Lewin, G.; Tenney, F. H. (Princeton Univ., NJ). Jap. J. Appl. Phys.; No. Suppl. 2, 221-224(1974).

From 6th international vacuum congress; Kyoto, Japan (25 Mar 1974). See CONF-740353–.

The design and operation of D–T fusion reactors based on the tokamak configuration is described with special emphasis on the vacuum aspects. Particular reference is made to the reactor study of the Princeton Plasma Physics Laboratory. Vacuum requirements of two other reactor studies based on the theta pinch and the mirror configuration are briefly mentioned. Problems arising from the radioactivity of the tritium and the high, locally variant temperatures are discussed. (auth)

6218 VACUUM PROBLEMS IN PLASMA PHYSICS AND CONTROLLED NUCLEAR FUSION. Prevot, F. (CEN, Fontenay-aux-Roses, France). Jap. J. Appl. Phys.; No. Suppl. 2, 225-231(1974).

From 6th international vacuum congress; Kyoto, Japan (25 Mar 1974). See CONF-740353–.

Vacuum problems in CTR involve a number of new aspects which make them different and often more difficult and complex than in any other fields of application. The first important aspect is the existence of the plasma itself which is at the same time a large source of neutral gas and a powerful internal pump. Interaction between neutral gas and plasma is very different whether the plasma is transparent or opaque to neutral atoms or molecules. The second important aspect is the influence of the walls on plasma pollution by high Z atom induced emission. These two phenomenons play an important role in the energy balance of both laboratory plasmas and future thermonuclear reactors. Concerning the vacuum system of thermonuclear reactor, the enormous size of the vessel and pumping speed requested and some safety problems inherent to tritium handling and neutron activation must be specially mentioned. Several solutions have been proposed and partially tested in present experiments: choice of the material of the wall, baking and surface processing, pumping and auxiliary equipments, magnetic divertor and protective layer of cold plasma. Examples of typical cases will be presented and discussed. (auth)

6219 VACUUM TECHNIQUE OF NUCLEAR FUSION INSTALLATIONS. Pustovoit, Y. M. (Inst. of Atomic Energy, Moscow). Jap. J. Appl. Phys.; No Suppl. 2, 233-239(1974).

From 6th international vacuum congress; Kyoto, Japan (25 Mar 1974). See CONF-740353–.

The vacuum techniques and methods applied in nuclear fusion installations of the USSR are shown using Ogra-III and Tokamak TO-1 installations. (auth)

6220 COMPOSITION PROFILES OF SEVERAL CONTAMINATED AND CLEANED SURFACES OF GOLD THICK FILMS ON COPPER PLATES BY AUGER ELECTRON AND SECONDARY ION MASS SPECTROSCOPY. Komiya, S.; Mizuno, M.; Narusawa, T.; Maeda, H.; Yoshikawa, M. (ULVAC Corp., Hagisono, Japan). Jap. J. Appl. Phys.; No. Suppl. 2, 363-366(1974).

From 6th international vacuum congress; Kyoto, Japan (25 Mar 1974). See CONF-740353–.

Preparation and evaluation of a clean Au film are investigated. Development of a preparation method for obtaining clean surface on a copper shell in the JFT–2a (DIVA) TOKAMAK toroidal vacuum chamber is the aim of the present work. Au films prepared by ion plating and vacuum evaporation have been analyzed by a cylindrical mirror Auger electron analyser in combination with a quadrupole mass spectrometer during a 2 keV Xe ion bombardment from a sputter ion gun over the whole range of thickness of several microns. Contaminants are found to segregate on the top surface and at the interface. To expose a clean Au surface by the ion bombardment, surface layers within 1000 Å had to be removed from the surfaces contaminated by touching with either a naked hand or a nylon glove or covered by a small amount of Ti. Mutual diffusions across the interfaces are also analysed as a function of the substrate temperature. A Nb sandwich layer inhibits effectively the mutual diffusion. (auth)

6221 EXPERIMENTAL STUDY OF A PLASMA CHAMBER MADE OF ALUMINA. Frank, R. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Service d'Ionique Generale). Vide; 29: No. 170, 314–321(Mar 1974). (In French).

The problem of impurities is a crucial one in the experiments of plasma physics and thermonuclear fusion for the energy balance equations. A large amount of impurities is released by the wall of the vacuum vessel. In the Tokamak type experiments the wall of the vacuum vessel is generally made of stainless steel. In the experiment PETULA built in Grenoble half part of the vacuum vessel will be made of aluminium oxyde so as to make it possible to introduce High Frequency power in the plasma. Studies on outgassing of aluminium oxyde in ultra high vacuum (10^{-9} torr) and facing a dense plasma are reported. The mass spectrum and the partial pressures of the different impurities are measured with a mass analyzer.

Wave Phenomena

6222 (IPP-4/78) GRAZING INCIDENCE COUPLING TO THE LOWER-HYBRID RESONANCE. Puri, S.; Tutter, M. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F. R. Germany)). Oct 1974. 16p. INIS.

2 figs.; 14 refs.

The boundary value problem of "grazing incidence" coupling to the lower-hybrid resonance is studied under idealized conditions. It is found that in addition to the n_z approximately equal to 1 (n_z is the logitudinal refractive index) mode, a significant fraction of the incident energy is coupled to a slow wave, thereby greatly enhancing the plasma penetration by the radio frequency wave. The slow mode exists as an eigensolution of the waveguide formed between the metallic wall and the reactive surface impedance of the plasma. The slow wave is sufficiently retarded to permit accessibility to the lower-hybrid resonance for any foreseeable low-β experiment. The "grazing incidence" approach thus combines the advantages of accessibility as well as matching without having to construct any extensive structure within the machine walls. (auth)

6223 (ITP-74-116P) KINETIC EFFECTS IN A HALF-SPACE PLASMA. Zasenko, V. I.; Pavlenko, V. N. (AN Ukrainskoj SSR, Kiev, Inst. Teoreticheskoj Fiziki). 1974. 8p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The effects of an echo in half-space plasma with sharp boundary for a random low of the reflection of electrons from plasma boundary ($0 \leq \rho \leq 1$) are studied disregarding the self-consistent field in a free streaming approximation. Considered are the cases where the excitation of two longitudinal or transverse primary oscillations with frequencies ω_1 and ω_2 at the same point of plasma at a distance l from the boundary produced a non-linear echo signal at a distance $l^1 = (\omega_2 + \omega_1/\omega_2 - \omega_1)l$ from plasma boundary. (auth)

6224 (ITP-74-117P) ECHO IN THE HALF-SPACE PLASMA. Sitenko, A. G.; Pavlenko, V. N.; Zasenko, V. I. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1974. 8p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The papers considers the echo phenomena in half-space plasma for the case of the mirror reflection of electrons from plasma boundary arising with the excitation of the electric field oscillations with frequencies ω_1 and ω_L at the same point at a distance l from the boundary. The echo oscillations occur at a frequently $\omega_3 = \omega_2 - \omega_1$ and their intensity maximum is situated at a distance $l^1 = (\omega_2 + \omega_1/\omega_L - \omega_1)l$ from the boundary. (auth)

6225 (RISO-M-1790) ION ACOUSTIC WAVES IN THE PRESENCE OF HIGH FREQUENCY OSCILLATIONS. Pecseli, H. L. (Danish Atomic Energy Commission, Risoe. Research Establishment). Feb 1975. 20p. Dep. NTIS (US Sales Only) $4.00.

Spatially varying high frequency oscillations will influence the electron motion in plasmas (through ponderomotive forces) and in turn affect the characteristics of ion acoustic oscillations. The dielectric function is derived for long wavelength, low frequency ion acoustic waves in the presence of high frequency, short wavelength oscillations. Apart from reproducing well known results this dielectric function shows the possibility of unstable ion acoustic waves for extreme intensities of high frequency oscillations. It is demonstrated that moderate intensities have a stabilizing effect on linearly unstable double humped ion distribution functions and it is argued that this effect may be of importance in laboratory experiments. (auth)

6226 (UCRL-76612) LIMITATION OF BRILLOUIN SCATTER IN PLASMAS. Kruer, W. L.; Valeo, E. J.; Estabrook, K. G. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 18 Apr 1975. 18p. (CONF-750437-1). Dep. NTIS $4.00.

From 5th annual symposium on anomalous absorption of intense high frequency waves; Livermore, California, USA (22 Apr 1975).

A simple model is proposed for the limitation of Brillouin backscatter often observed experimentally. This limitation is a natural consequence of the limited mass and heat capacity of the underdense plasma supersonically. For plasmas prepared by a prepulse, the reflectivity could then be time-dependent in agreement with some recent experimental measurements. (auth)

ENGINEERING

Energy Conversion

6227 (MND-3251-3) RESEARCH AND TECHNOLOGY IMPLICATIONS REPORT, SATURN-RIPS STUDY. (Martin Marietta Corp., Baltimore, Md. (USA)). Feb 1966. 16p. Dep. NTIS $4.00.

Declassified 22 Jun 1972.

Those areas of research and technology where further efforts would be desirable are identified, based on results of the Saturn Instrument Unit-Saturn LEM Adapter (SIU-SLA) radioisotope power supply (RIPS) study. A summary of the pertinent results from the Saturn-RIPS integration study is presented to form the basis for this evaluation. (auth)

6228 (MND-3607-131-2) SNAP POWER SYSTEM FOR DODGE-M SATELLITE, TECHNICAL DESCRIPTION. (Martin Marietta Corp., Baltimore, Md. (USA)). Mar 1967. 104p. Dep. NTIS $8.25.

Declassified 22 Jun 1972.

A SNAP-19 type thermoelectric generator was studied for determining the practicality of this unit for meeting the power requirements, 100 to 150 W, of the Dodge-M satellite. Information is included on the radioisotope thermoelectric generator design, capsule design, instrumentation, spacecraft electrical system, system reliability, and ground support equipment. (LCL)

6229 (MND-5209) MODIFIED SNAP 19 FOR NAVY NAVIGATION SATELLITE. (Martin Marietta Corp., Baltimore, Md. (USA)). 20 Feb 1968. 66p. Dep. NTIS $6.50.

Declassified 22 Jun 1972.

An evaluation is presented of the application of the SNAP 19 to fulfill the requirement for an RTG for the Navy Navigation Satellite (NAVSAT). It was concluded that, with minimum modifications, the SNAP 19 generator will meet all currently identified requirements of the NAVSAT missions. (auth)

Facilities and Equipment

Refer also to abstracts 7025, 7901, and 8354.

6230 (CONF-741232-, pp 147-150) IRRADIATION CREEP: DEVICE AND FIRST RESULTS. Cartier, L. (CEA-CEN, Cadarache, France); Dupouy, J. M. 1974. (In French).

From European conference on irradiation behaviour of fuel cladding and core component materials; Karlsruhe, F. R. Germany (3 Dec 1974).

In European conference on irradiation behaviour of fuel cladding and core component materials.

A device for the continuous measurement of creep in the central Rapsodie channel was developed. The characteristics and operating principles are outlined. Some slight operating deficiencies found in the first operating tests are reported. (JSR)

6231 (CONF-750413-P2, pp IV,39-IV,53) FINITE ELEMENT AND DIFFERENCE FORMULATIONS OF TRANSIENT FLUID-STRUCTURE PROBLEMS. Belytschko, T. B. (Univ. of Illinois, Chicago); Kennedy, J. M.; Schoeberle, D. F. 1975.

From ANS computational methods in nuclear energy; Charleston, South Carolina, USA (15 Apr 1975).

In proceedings of the conference on computational methods in nuclear engineering. Vol. II. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.; Energy Research and Development Administration, Aiken, S. C. (USA). Savannah River Operations Office).

A finite element formulation is developed for the two dimensional problem of structural elements in a fluid environment, subjected to high, transient pressures. The emphasis is on short duration loads, so a Lagrangian description is used. The finite element equations for the hydrodynamic fluid are first derived from a conservation of energy approach: it is also indicated how the use of a weak form of the partial differential equations leads to the same form. The equations are then compared to the widely used finite difference equations as developed by Wilkins. It is shown that Wilkins' use of a contour integral to develop the difference formulas also corresponds to the development of a weak form, and that the resulting discrete equations are identical to the finite element equations, both at interior mesh points and along prescribed pressure boundaries. The major difference between the two methods appears to be a matter of form: whereas finite difference methods formulate the equations of motion directly in terms of stresses, the finite element methods use intermediate nodal forces. The latter is shown to facilitate the incorporation of structural elements. (auth)

6232 (CONF-750617-3) ELEVATED-TEMPERATURE TESTS OF SIMPLY-SUPPORTED BEAMS AND CIRCULAR PLATES SUBJECTED TO TIME-VARYING LOADINGS. Corum, J. M.; Richardson, M. (Oak Ridge National Lab., Tenn. (USA)). 1975. 30p. Dep. NTIS $4.50.

From 2nd ASME national congress on pressure vessels and piping; San Francisco, California, USA (24 Jun 1975).

The measured elastic-plastic and elastic-plastic-creep responses of a number of simply-supported type 304 stainless steel beams and circular plates are presented. Beams and plates exhibit the essential features of inelastic structural behavior; yet they are relatively simple. In beams, the stress fields are largely uniaxial, while multiaxial effects are introduced in plates. The specimens were laterally loaded at the center, and the tests were performed by subjecting the specimens to either a prescribed load or center-deflection history. The specimens were machined from a common, well-characterized heat of material, and all of the tests were performed at a temperature of 1100 F. The elastic-plastic tests consisted of short-time cycling of the center load, or deflection, between fixed limits. In the elastic-plastic-creep tests the center load, or deflection, was held constant for periods of time, but was periodically subjected to a step increase or decrease, including reversals. The test results are presented in terms of the load and center-deflection behaviors, which typify the overall structural behavior. (auth)

6233 (JAERI-M-5880) LIVIELA: VISCO-ELASTIC STRESS ANALYSIS PROGRAM USING FINITE ELEMENT METHOD. Ikushima, T. (Japan Atomic Energy Research Inst., Tokyo). Nov 1974. 77p. (In Japanese). INIS.

Computer program LIVIELA has been prepared for analyzing the visco-elastic stress of two dimensional or axis-symmetric structures. The features of the program are: (1) calculable items are temperature, and stress due to irradiation strain, thermal strain, external load, displacement, pressure and their combinations; (2) it can be applied to the transversely anisotropic materials; creep function is considered for the transient creep and the steady creep; (4) it can treat time-depend material property; (5) it is considered to make easy input data and mesh generation of elements; (6) numerical analysis is performed by the displacement method and the successive overrelaxation method; (7) calculation results can be represented with a graphic plotter; (8) limitations of the calculation are maximum elements 1200, maximum nodes 800, maximum materials 40, maximum calculation steps 60; (9) only the input data and results which users request can be printed; and it can be output various check prints. The program is written in FORTRAN IV and can be used with FACOM 230-60, and usable memory is about 100 k words. (auth)

6234 (KFK-2093) MULTI-PURPOSE SODIUM TEST LOOP ML-1 AT THE MADRID NUCLEAR ENERGY CENTER. Oitra Oitra, F ; Leising, H. A.; Bojarsky, E. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Material- und Festkoerperforschung). Dec 1974. 23p. (In German). INIS.

4 figs.

In summer 1973 a multi-purpose sodium test facility was commissioned on the site of the Spanish nuclear energy center of Madrid, which had been built within the framework of German-Spanish cooperation in the field of peaceful use of nuclear energy. A survey is presented of the layout of this up-to-date facility with its multiple means of experimentation. The various safety precautions are also described. In addition to a basic or purification loop with a 5 m^3 sodium dumping tank, a cold trap, a pluggingmeter, etc., a main loop and a corrosion loop have been provided which can be run separately from each other. While the main loop serves to supply several different test sections, the corrosion loop has been designed as a complete component containing specimen recipients in the sodium flow with rising and reducing temperatures (max. 730°C), a cold trap of its own, a hot trap, an electrochemical O_2-measurement probe, a sodium sampling station, and a pluggingmeter. (auth)

6235 (N-74-33976) TECHNOLOGY FOR THE PRODUCTION OF SPACE EQUIPMENT. Breslavets, A. V.; Pyak, B. N.; Shcherbakov, V. V.; Gryunval'd, D. G. (eds.). Sep 1974. Translated from pp 1-134 of Tekhnologiya Proizvodstva Kosmicheskoy Apparatury, Nauka Press, Moscow, 1974. (NASA-TT-F-15766). 146p. NTIS $10.50.

Separate abstracts were prepared for two of the twenty sections of the report. The remaining eighteen sections were not in the subject scope of NSA. (TFD)

For abstracts of individual sections see: 6249 and 6539.

6236 (ORNL-TM-4899) DEVELOPMENT OF NONDESTRUCTIVE EVALUATION TECHNIQUES FOR LARGE ROCK SPECIMENS. Foster, B. E.; Snyder, S. D.; McClung, R. W. (Oak Ridge National Lab., Tenn. (USA)). Jun 1975. Contract W-7405-eng-26. 72p. Dep. NTIS $6.75.

Studies on the applicability of radiographic techniques to specimens of stressed rock are presented. The effort is a part of a program on mine safety sponsored by the U. S. Bureau of Mines and is related to the structural integrity of the roof of the mine. High-voltage radiography was performed on specimens of limestone, shale, and sandstone, both unstressed and stressed by one of four selected expansion anchors. Experiments were conducted to optimize (1) the techniques for producing the radiographs and (2) the quantitative microdensitometry on radiographs of stressed and unstressed blocks. A unique microdensitometric scanning and data processing system using correlation techniques was developed and applied so that a subtle difference (as small as 0.01 density unit) previously unobservable could be extracted from the background and recorded. Also, multiple sets of radiographs were made of specimens of limestone and sandstone, both unstressed and stressed by each of eight expansion anchors, to examine qualitatively the range of possible expansion anchor-rock specimen combinations of interest to rock-mechanics researchers. Experiments were conducted on simple beam specimens of limestone stressed in both compression and tension to develop (1) an understanding of the radiographic phenomenon, and (2) quantitative relationships between changes in x-ray transmission and stress. (auth)

6237 (RD/B/N-3232) SIMPLE THERMAL SYPHON SODIUM LOOPS. Gwyther, J. R.; Marshall, P.; Rowe, D.; Withrington, D. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Nov 1974. 10p. Dep. NTIS (US Sales Only) $4.00.

The design, construction, commissioning and operation of small-scale thermal syphon loops is described. The loops operate within the temperature range of 120 to 700°C, with sodium flow rates of a few cms.sec^{-1} and sodium inventories of 300g. The sodium chemistry is monitored by a cold trap and a carbon meter. (auth)

6238 (RDT-P-4-3T(3-75)) METAL-SHEATHED, MINERAL-INSULATED ELECTRICAL RESISTANCE HEATER. (Energy Research and Development Administration, Washington, D. C. (USA). Div. of Reactor Research and Development). Mar 1975. 23p. RSO.

The heater is applicable to liquid metal heat transfer systems for preheating (low temperature) and for component operating temperatures up to 677°C, where the heaters are mounted either directly on the component surface to be heated, on standoffs in the gas space between the component surface and the thermal insulation, or are mounted with the heated lengths immersed in liquid metal. (auth)

6239 (TRG-2382(R)) CONIDA: A FINITE ELEMENT PROGRAM FOR THE STRESS ANALYSIS OF AXISYMMETRIC THIN SHELLS. Clarke, P. W. (UKAEA Reactor Group, Risley). Dec 1974. 31p. Dep. NTIS (US Sales Only) $4.75.

The use of orthotropic truncated conical elements allows elastic stress analysis of thin axisymmetric shells subject to axisymmetric loading. Stiffners and stress matrices for the elements are derived and data requirements for the program are described. (auth)

6240 (TRG-Report-2414(R)) PIECE-WISE CONTINUOUS FINITE ELEMENT FOR THE STRESS ANALYSIS OF PLATES AND SHELLS. Jobson, D. A. (UKAEA Reactor Group, Risley). Mar 1975. 22p. Dep. NTIS (US Sales Only) $4.25.

The implementation of general-purpose programs for the numerical analysis of plate and shell structures calls for the adoption of finite element stiffness expressions which take account of both lateral distortion and membrane action. It is particularly desirable that design-oriented programs of the above kind be perfectly general. In particular the element behavior must be independent of the choice of base axes, and not prone either to singularities or to doubts over convergence with successive mesh refinement. Ideally the program should allow the assembly of relatively simple elements, oriented in any conceivable way and of any freely chosen shape. The present paper documents a procedure for obtaining stiffnesses for a three node element which satisfies the above requirements. Lateral distortion of such an element calls for curvature changes across its surface. Consequently the element is conceptually subdivided into congruent subregions having the same curvature and twist along adjoining edges, while changes of curvature in directions perpendicular to the latter are allowed. Comparison with a basic cell of grid elements shows perfect accord for homogeneous flexure, which is the laterally deflected state to which each element must tend for a sufficiently fine mesh. (auth)

6241 (UCRL-50016-75-1) MECHANICAL ENGINEERING DEPARTMENT QUARTERLY REPORT, JANUARY–MARCH 1975. Stone, R. G.; Barnett, J. M. (eds.). (California Univ., Livermore (USA). Lawrence Livermore Lab.). 31 Mar 1975. Contract W-7405-Eng-48. 17p. Dep. NTIS $4.00.

Progress during January to April 1975 is reported in the development or study of the following: a computer-designed actuator for quick-closure systems that uses pyrotechnically generated gas for both acceleration and deceleration; high-speed cryogenic pumps and high-voltage isolation equipment as components for use in the production of high-energy beams of neutral atoms; and a piezoelectric-supported thrust bearing for the tool slide of a diamond turning machine. (LCL)

6242 (UCRL-76038) USE OF PROBABILISTIC TECHNIQUES IN DESIGNING PIPES AND PRESSURE VESSELS. Wells, J. E. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 17 Dec 1974. 19p. (CONF-750617-12). Dep. NTIS $4.00.

From 2nd ASME national congress on pressure vessels and piping; San Francisco, California, USA (24 Jun 1975).

Probabilistic techniques are described that enable the design engineer to make reliability estimations during the design phase based on variability evaluations of quantitative design parameters. Statistical distributions are discussed for stress and strength, and techniques are presented for incorporating these distributions into the design process. The use of statistical techniques in fracture mechanics is also discussed. (auth)

Lasers

Refer also to abstract 6214.

6243 (AD-780421) OPTICAL EFFECT OF A SPHERICAL END PLATE ON A LASER BEAM. Derderian, G. (Naval Training Equipment Center, Orlando, Fla. (USA)). May 1974. 6p. NTIS $3.00.

A mathematical analysis is presented of the deteriorating effect of a spherical end plate on a collimated laser beam. (GRA)

6244 (AD-787471) MICROWAVE WAVEGUIDE MODULATORS FOR CO_2 LASERS. Semiannual Technical Report No. 4, 25 March–25 September 1974. Cheo, P. K.; Gilden, M.; Fradin, D.; Wagner, R. (United Aircraft Research Labs., East Hartford, Conn. (USA)). 25 Sep 1974. Contract N00014-73-C-0087. 37p. (UARL-N-921513-8). NTIS $3.75.

During this reporting period four significant advances have been made. The first two concern the structural quality of GaAs waveguides. The grating couplers which are an integral part of the waveguide structure are now being made by ion-beam milling technique instead of rf sputter-etching. This change of etching technique has provided remarkable improvement in the fabrication procedure. The second improvement involves the ruggedization of GaAs waveguide structure. The strength of a chemo-mechanically polished GaAs slab is very weak and has caused some difficulties during handling and processing cycles. A relatively strain-free metalization process by which thin layers of nickel-copper are deposited on the surfaces of GaAs slab has been developed. The metallic layer has provided a considerable strength to the GaAs waveguide structure. The next two significant accomplishments relate to the microwave aspects of the modulator development. One of the most significant result during this interim period is the experiment employing very high power to test the modulator. The result indicates that no failure is expected under a cw mode operation of this modulator at an input microwave power level in excess of 100 W. (GRA)

6245 (AD/A-001840) ELECTROMAGNETIC THEORY OF DISTRIBUTED FEEDBACK LASERS IN PERIODIC DIELECTRIC WAVEGUIDES. Evans, G. A. (California Inst. of Tech., Pasadena (USA). Antenna Lab.). Sep 1974. 181p. (AFOSR-TR-74-1747). NTIS $7.00.

A theory for distributed feedback lasers in transversely bounded structures is developed. The space harmonics approach is used to discuss the general properties of periodic structures. The coupled mode approach is used to develop expressions for the threshold gain, longitudinal mode structure, and electromagnetic field distribution for distributed feedback lasers. Three basic structures are considered for distributed feedback lasers — thin film waveguides, diffusion waveguides, and fiber waveguides. Equations for the amplification of a waveguide mode that extends transversely over both regions with and without gain are derived. Analytical expressions are derived for coupling between modes in periodically perturbed dielectric waveguides. Sinusoidal perturbations of the electric permittivity and of the waveguide boundary are considered. (GRA)

6246 (AD/A-002275) PARAMETRIC ANALYSIS OF A DF–CO_2 TRANSFER LASER. Final Report, September 1973–August 1974. Schorr, C. J.; Furner, T. E. (Bell Aerospace Co., Buffalo, N. Y. (USA)). Oct 1974. Contract N00014-74-C-0019. 74p. (BAC-9224-920001). NTIS $4.25.

Computations were made using nozzle design computer programs and general kinetics codes to model the NRL transfer chemical laser, and to suggest design changes that would yield higher output power. The effect of deactivators such as Hf, N_2, and H_2O, and different CO_2 concentrations on laser performance was evaluated. The major conclusions of this study are that additional F_2 in the NRL system will increase the performance. The water present in the system, while required for GDL operation, is detrimental. In the NRL system D_2 was injected upstream of the throat of a 24 nozzle bank. This study indicated that laser performance should improve if the D_2 were injected in the optical cavity at the primary nozzle exit. To study this, a nozzle bank of 50 dual slit nozzles was designed. (GRA)

6247 (AD/A-002484) NITROGEN ION LASER. Semiannual Technical Report No. 5, 1 March–30 September 1974. Collins, C. B.; Cunningham, A. J. (Texas Univ., Dallas (USA). Richardson Center for Advanced Studies). 1 Oct 1974. Contract N00014-67-A-0310-0007. 91p. NTIS $4.75.

The characterization of the nitrogen ion laser pumped by charge transfer from He_2^+ is reported. Intense laser emission in the violet at 427 nm has been observed and found to have a linewidth less than 0.3Å. The pumping ion, He_2^+, was produced by discharge of a fast-pulsed electron beam gun, Apex-1, into 7 atmospheres of a mixture of helium and nitrogen. Excitation current densities were 1.4ka/cm^2 at 1 mV over a 1 × 10 cm transverse geometry. Efficiency is discussed. (GRA)

6248 (AD/A-002586) REVIEW OF PARAMETRIC OSCILLATORS AND MIXERS AND AN EVALUATION OF MATERIALS FOR 2–6 MICROMETER APPLICATIONS. Nichols, E. R.; Corbin, J. C. Jr.; Donlan, V. L. (Air Force Avionics Lab., Wright-Patterson AFB, Ohio (USA)). Jul 1974. 119p. (AFAL-TR-74-161). NTIS $5.25.

A tunable source of narrow line radiation in the 2 to 6 micrometer band and, to a lesser extent, the 8 to 12 micrometer band would be useful in several military applications. Only recently have nonlinear optical materials become available to permit construction of optical parametric oscillators (OPO's) and mixers operating at these wavelengths. In this report, a review of the progress in wavelength coverage and output of OPO's and mixers is given, the theoretical performance of eleven nonlinear materials is discussed in detail, and as an example, the materials are compared for use in operating a singly resonant OPO in the 3 to 6 micrometer band. For this application, the outstanding materials are HgS pumped at 1.06 micrometers and $ZnGeP_2$ pumped at 2.1 micrometers. Other material performances discussed are Ag_3AsS_3 (proustite), $AgGaS_2$, $AgGaSe_2$, Ag_3SbS_3, $CdGeAs_2$, CdSe, $LiIO_3$, $LiNbO_3$ and Tl_3AsSe_3. Refractive index data on the nonlinear materials and details of the fortran computer program used in the calculations are included. (GRA)

6249 (N-74-33976, pp 25-30) DEVELOPMENT AND PLANNING AND DESIGN OF EQUIPMENT PUMPING GENERATOR OF SEMICONDUCTOR LASERS. Popkov, A. V. Sep 1974. Translated from pp vp of Tekhnologiya Proizvodstva Kosmicheskoy Apparatury, Nauka Press, Moscow, 1974.

In technology for the production of space equipment.

A study is made of the schematic of a multidimensional current pulse generator. A MTKh-90 cold cathode thyratron is used as the current commutator. In the auto-oscillation mode on a frequency of 380 Hertz the generator creates a current to 100 amps per pulse in a control resistance of 1 ohm. The pulse duration is regulated within the limits from 0.1 to 3.0 microseconds. There are two tables, three illustrations and a four-entry bibliography. (auth)

6250 (N-74-34013) HETERODYNE METHOD OF MEASURING THE DIFFUSIVE COMPONENT OF LASER MIRRORS. Dushkov, I. I.; Karlov, N. V.; Krynetskii, B. B.; Mishin, V. A.; Peterov, R. P. Translated from Kratk. Soobshch. Fiz.; No. 10, 10-15(1971). 8p. (NASA-TT-F-15969). NTIS $4.00.

A modified Michelson interferometer, for measurement of the diffusive component of laser mirrors at various angles of incidence by the heterodyne method, is described and illustrated. Radiation diffusively reflected in the direction opposite to the incident beam was recorded by use of a GeHg photoresistor at liquid nitrogen temperature. Curves of the diffusive reflection power vs. angle of incidence and data on the contribution of the diffusive component are presented. (auth)

6251 (N-74-34906) INVESTIGATION OF THE BASIC FOUNDATIONS OF MASERS AND LASERS. Final Report, 1 January 1965–30 June 1974. Lamb, W. E. Jr. (Yale Univ., New Haven, Conn. (USA). Dept. of Physics). 30 Jun 1974. 17p. (NASA-CR-140512). NTIS $4.00.

Research work on the theory of lasers and masers is reported. Special attention is given to technological applications of laser theory. (auth)

6252 (SAND-75-5461) ELECTRON-BEAM-DRIVEN HIGH-POWER HYDROGEN FLUORIDE LASERS. Gerardo, J. B. (Sandia Labs., Albuquerque, N. Mex. (USA)). [nd]. 4p. (CONF-750520-4). Dep. NTIS $4.00.

From IEEE Optical Society of America conference on laser engineering and applications; Washington, District of Columbia, USA (28 May 1975).

A laser that produces a 4.2 kJ pulse is briefly described. Pulse widths from the laser ranged from 20 to 30 ns; peak power was about 200-billion W. The 4.2-kJ pulse is nearly double the previous record pulse for an HF laser, also an electron-beam-driven system located at Sandia. The HF pulse was produced by injecting an intense beam of electrons from the REBA accelerator into a 2.3-m-long, 15-cm-dia tube filled with hydrogen, fluorine, sulfur-hexafluorine, and oxygen at pressures up to two atmospheres. A 3-kG magnetic field guided the electron beam along the axis of the gas-filled cell. REBA delivers a 50 kA beam of 2-MeV electrons in a 70 ns-wide pulse. (auth)

6253 (Y-DA-5974) IMPROVING A PRODUCTION LATHE TO MACHINE OPTICAL COMPONENTS FOR HIGH-ENERGY LASERS. Gerth, H. L. (Oak Ridge Y-12 Plant, Tenn. (USA)). 12 May 1975. Contract W-7405-eng-26. 15p. (CONF-741108-5). Dep. NTIS $4.00.

From society of manufacturing engineers conference; San Francisco, California, USA (19 Nov 1974).

This work was done to see if an existing production machine could be upgraded to the capability required for fabricating optical reflectors for high-energy lasers. A horizontal, two-axis, numerically controlled, T-base turning machine was chosen for this project. Modifications were made to the spindle drive mechanism, slide bearings, and machine support system. (auth)

6254 (Y-DA-5975) DIAMOND TURNING ON ADVANCED MACHINE TOOL PROTOTYPES. Arnold, J. B.; Steger, P. J. (Oak Ridge Y-12 Plant, Tenn. (USA)). 12 May 1975. Contract W-7405-eng-26. 21p. (CONF-741108-4). Dep. NTIS $4.25.

From Society of Manufacturing Engineers conference; San Francisco, California, USA (19 Nov 1974).

Specular-quality metal mirrors are being machined for use in laser optical systems. The fabrication process incorporates special quality diamond tools and specially constructed turning machines. The machines are controlled by advanced control techniques and are housed in an environmentally controlled laboratory to insure ultimate machine stability and positional accuracy. The materials from which these mirrors are primarily produced are the softer face-center-cubic structure metals, such as gold, silver, copper, and aluminum. Mirror manufacturing by the single-point diamond machining process is in an early stage of development, but it is anticipated that this method will become the most economical way for producing high-quality metal mirrors. (auth)

6255 SMALL-SIGNAL GAIN MEASUREMENTS AND VIBRATIONAL DISTRIBUTION IN CO. Brechignac, P. (CNRS, Cachan, France); Martin, J. P.; Taieb, G. IEEE J. Quant. Electron.; QE-10: No. 10, 797-802(Oct 1974).

Small-signal gain measurements on a large number of vibrational-rotational lines in a CO-laser plasma have led to the vibrational distribution from the v equals 2 to v equals 31 level. The relative influence of V-V and V-T relaxation processes is discussed. (auth)

6256 PROBE MEASUREMENTS OF Ar^+-LASER PLASMA PARAMETERS. Kitaeva, V. F.; Osipov, Yu. I.; Sobolev, N. N.; Shelekhov, A. L.; Agheev, V. P. (Lebedev Inst. of Physics, Moscow). IEEE J. Quant. Electron.; QE-10: No. 10, 803-809 (Oct 1974).

The results of local investigations of Ar^+-laser plasma parameters by a new pulsed single-probe method are presented. The experiments were carried out in a 10-mm-bore tube at discharge currents of 60 to 80 A and argon pressure of 0.2 to 1 torr. Electron concentrations and temperature distributions over the discharge-tube radius have been determined. Based on the results obtained, a number of Ar^+-laser plasma parameters have been estimated. The results are compared with the available model theories of the Ar^+ laser. (auth)

6257 RADIATION FIELDS OF GaAs–(AlGa)As INJECTION LASERS. Butler, J. K.; Zoroofchi, J. (Southern Methodist Univ., Dallas). IEEE J. Quant. Electron.; QE-10: No. 10, 809-815(Oct 1974).

Theoretical radiation patterns from a multilayer model of a dielectric waveguide are fitted to single mode experimental

profiles of three symmetrical double-heterojunction cavities to test the adequacy of the model and study the effect of the dielectric parameters on the beam pattern. The radiation from the normal TE modes is approximated by plane waves, while for the TM modes it is given by boundary value solutions of the Maxwell equations. The adequacy of the theory is shown by the faithfulness of the fit out to large beam angles and low intensities, and the agreement of the adjusted cavity parameters to the experimental values. Small changes in either the cavity thickness or the dielectric constant of the internal n-type region have similar first order effects on the angular position of the minima in the profile as well as in the amplitude of the sidelobes. Depths of the minima decrease with departures of the structure from planarity. Pattern distortion from mode coupling at the interfaces and facets is not observed. (auth)

6258 NEW METHOD FOR DETECTING TRANSIENT GAIN (OR LOSS) IN PULSED GAS DISCHARGES. Pappalardo, R.; Lempicki, A. (GTE Labs., Inc., Waltham, MA). IEEE J. Quant. Electron.; QE-10: No. 10, 816-818(Oct 1974).

A pulsed argon discharge inside a cw-laser cavity is used to modulate the cw-laser output via the transient gain/loss at various lasing wavelengths. Under short-pulse excitation (approximately 0.6 mu s), gain is found at four Ar(II) lasing lines, but losses are observed at 4880 and 5017 A. A similar diagnostic device with broad-band capabilities and based on an ion-laser-pumped dye laser is proposed. (auth)

6259 LONG-PULSE HIGH-ENERGY CO_2 LASER PUMPED BY AN ULTRAVIOLET-SUSTAINED ELECTRIC DISCHARGE. Lind, R. C.; Wada, J. Y.; Dunning, G. J.; Clark, W. M. Jr. (Hughes Research Labs., Malibu, CA). IEEE J. Quant. Electron.; QE-10: No. 10, 818-821(Oct 1974).

A uv-sustained electric-discharge CO_2 laser has demonstrated optical energy-density extraction and long-pulse performance competitive with current e-beam sustained devices. Atmospheric-pressure CO_2-N_2-He mixtures seeded with tri-n-propylamine are volumetrically photoionized using the 1200 to 1700 A radiation from a spark-array source. Laser pulse lengths up to 37 mu s have been achieved with a specific energy of 47 J/l·atm. The best specific energy demonstrated was 60 J/l·atm in a 23-mu s pulse. (auth)

6260 EXPERIMENTS ON IMPROVED UNSTABLE MODE PROFILES BY APERTURE SHAPING. Maunders, E. A. (Northrop Research and Tech. Center, Hawthorne, CA); McAllister, G. L.; Steier, W. H. IEEE J. Quant. Electron.; QE-10: No. 10, 821-822(Oct 1974).

A 3.5-mu m He-Xe laser has been used to experimentally observe improvements in mode intensity profiles by shaping the cavity aperture. Significant improvements over circular apertures were achieved with elliptical and serrated mirror shapes. (auth)

6261 ESTIMATION OF THE INFLUENCE OF TURBULENCE INDUCED SCATTERING ON GASDYNAMIC LASER CHARACTERISTICS. Brunne, M. (Univ. of Washington, Seattle); Milewski, J.; Stanco, J.; Zielinski, A. Phys. Fluids; 18: No. 4, 458-463(Apr 1975).

The radiation output power losses due to the scattering induced by spatial nonuniformities of the medium refraction index are analyzed for an active cavity of the gasdynamic laser. The analysis is based upon the nonlinear equations of chemical kinetics. The attenuation of the coherent radiation power caused by the statistically homogeneous and isotropic flow nonuniformities is treated as a passive loss measured by an extinction coefficient related to the integral scale of the turbulence and the mean-square fluctuation of the refractive index. A set of straightforward analytical formulas is given for both the coherent and incoherent radiation power as well as for the laser efficiency. (auth)

6262 STUDY OF THE GAIN-DEPENDENT REFRACTIVE INDEX OF A CO_2 LASER. Honeycutt, T. E. University, AL; Univ. of Alabama (1974). 149p. University Microfilms Order No. 75-9908.

Thesis (Ph. D.).

Results of research directed toward the achievement of a better understanding of the gain-dependent index of refraction of an active CO_2 laser medium are presented. Experimentally discovered frequency-jumping and gain-discontinuity effects in a 3-mirror laser have been studied using a newly-developed mathematical model in which it was assumed that there was present a gain-dependent portion of the refractive index of the laser medium. The analytical results are related to the experimental results obtained from a long, 3-mirror, frequency-modulated CO_2 laser cavity. It was found that the simple model predicts, qualitatively, the experimental results. Specific results indicate that frequency pushing is the dominant mode interaction process in a reflective-type coupled-cavity laser, and that this process is more dependent upon the direction in which the laser frequency is swept than it is upon the location of the pertinent mode frequencies relative to the linecenter frequency. In a 3-mirror coupled-cavity structure, the effects of the gain-dependent portion of the refractive index of a CO_2 laser is more than two order of magnitude larger than the effects associated with the anomalous dispersion. As little as 10^{-7} W feedback to the laser cavity caused frequency-jumping and gain-discontinuity effects in the CO_2 ring laser whose gain was approximately 3 dB per pass. Similar results were obtained from an experimental arrangement which contained a straight, single-frequency CO_2 laser. (Diss. Abstr. Int., B)

6263 GENERATION OF STEP-TUNABLE FAR INFRARED RADIATION BY PHASE MATCHED DIFFERENCE FREQUENCY MIXING IN PLANAR DIELECTRIC WAVEGUIDES. Thompson, D. E. Urbana, IL; Univ. of Illinois (1974). 136p. University Microfilms Order No. 75-11,698.

Thesis (Ph. D.).

The generation of step-tunable far infrared radiation by difference frequency mixing various pairs of CO_2 laser lines in an optically nonlinear medium is analyzed. The addition of waveguide dispersion to bulk dielectric dispersion is examined, and the use of this combination to achieve phase matching of the difference frequency mixing interaction is investigated theoretically and experimentally. Milliwatt level pulsed signals are generated from 200 mu m to 800 mu m wavelength by mixing orthogonally polarized, Q-switched pulsed CO_2 laser signals in planar dielectric waveguides of GaAs. Data are correlated to the theoretical expectations of power, bandwidth, and output coupling angle and proposals are made for further uses of this far infrared, integrated optics configuration, nonlinear mixing device. (Diss. Abstr. Int., B)

6264 FORCED MODE LOCKING OF A SINGLE-LINE HIGH-PRESSURE CO LASER. Nurmikko, A. V. (Massachusetts Inst. of Technology, Cambridge). J. Appl. Phys.; 46: No. 5, 2153-2154 (May 1975).

Peak powers in excess of 1 kW and pulsewidths in the nanosecond regime have been measured by forcibly mode locking a high-pressure CO laser operating on single vibrational-rotational transitions. Successful short-pulse operation has been achieved on some 30 lines in the 5.1 to 5.3-mu wavelength region. (auth)

6265 AMPLIFICATION AND LASER ACTION IN A LASER DYE PUMPED BY A COPPER-VAPOR LASER. Decker, D. C.; Fahlen, T. S.; Falk, J. (GTE Sylvania, Inc., Mountain View, CA). J. Appl. Phys.; 46: No. 5, 2308-2309(May 1975).

The 5106-A output of a 250-mW copper-vapor laser has been used to obtain laser action in a Rhodamine 6G dye laser. The high gain of such a copper-vapor laser pumped dye solution has been demonstrated by amplifying the 5782-A output of the same copper-vapor laser. (auth)

6266 COUPLED LATERAL MODES IN NARROW STRIPE INJECTION LASERS. Sommers, H. S. Jr.; Butler, J. K. (RCA Labs., Princeton, NJ). J. Appl. Phys.; 46: No. 5, 2319-2322(May 1975).

A modal description of lasers having a facet intensity distribution with deep central minimum and beam profile in the junction plane with strong forward maximum, such as have been observed in various types of narrow stripe lasers is presented. The difference in symmetry between near and far field prevents analysis in terms of either simple Hermite-Gaussian or simple box modes. Simultaneous resolution in wavelength and beam angle shows that the longtudinal mode groups are doublets of which one member radiates a beam of even and the other odd symmetry. The observations are interpreted in terms of the theory of a pair of strongly coupled dielectric waveguides, one located under each edge of the metal stripe contact. A model calculation of a thin double-heterojunction wafer enclosing a pair of dielectric waveguides formed by small abrupt discontinuities, with parameters adjusted to reproduce the observed intensity distribution along the junction plane, gave a frequency splitting of about 0.1 A compared to the observed splitting of 0.6 A. (auth)

6267 DISCHARGE SPATIAL NONUNIFORMITY IN e-BEAM-SUSTAINER CO_2 LASERS. Theophanis, G. A.; Jacob, J. H.; Sackett, S. J. (Everett Research Lab., MA). J. Appl. Phys.; 46: No. 5, 2329-2331(May 1975).

The discharge in an electron-beam-sustainer atmospheric pressure CO_2 laser is investigated. An arbitrary two-dimensional geometry is employed in calculating the electric field. The conductivity is a function of the local electric field, the loss rate, and the ionization rate, the third of which is proportional to the energy deposition by high-energy electrons. The predicted discharge nonuniformities are compared with experimental results. Experimental evidence indicates that the discharge is recombination dominated. (auth)

6268 WAVE COMPETITION EFFECTS IN A TWO-MODE GAS RING LASER. Danileiko, M. V.; Kozubovskii, V. P.; Pavlik, B. D.; Shpak, M. T. (Inst. of Physics, Moscow). JETP Lett. (USSR) (Engl. Transl.); 20: No. 7, 220–221(5 Oct 1974).

Translated from Zh. Eksp. Teor. Fiz., Pis'ma Red; 20: No. 7, 483–485(5 Oct 1974).

A method of obtaining very narrow and contrasty resonances in a two-mode gas ring laser is proposed and realized. The resonances result from the jumplike change in the lasting regime on passing through the symmetrical position of the modes relative to the line center. Their possible applications are discussed. (auth)

6269 CHEMICAL LASERS. Eletskii, A. V. Khim. Plazmy; No. 1, 67–119(1974). (In Russian).

A critical review is presented of the development and properties of chemical lasers. A chemical laser is defined as a laser in which formation of inverse populations are caused by one or more chemical reactions. This class of lasers includes photodissociation lasers, dissociative recombination lasers, and gas dynamic lasers in which the formation of active molecules occurs as a result of the oxidation of the fuel. The principles of amplification in molecular gases are first examined. Dissociation lasers, CO_2 lasers, and hydrogen halide lasers are discussed in separate sections. 232 references. (JSR)

6270 FLASHLAMP PUMPED RHODAMINE 6G-DYE LASER. Chis, I. D.; Julea, T. N.; Popescu, I. M. (Inst. of Atomic Physics, Bucharest). Rev. Roum. Phys.; 19: No. 9, 1005–1007(1974).

The design and performance of a laser system composed of an aluminum circular cylindrical cavity (55 mm ID, 150 mm long) in which the flashlamp and the dye cell are placed are briefly described. (TFD)

6271 He–Ne LASER STABILIZED BY SATURATED ABSORPTION IN I_2. Helmcke, J.; Bayer–Helms, F. pp 104 of Conference on Precision Electromagnetic Measurements. London; Inst. of Electrical Engineers (1974).

From conference on precision electromagnetic measurements; London, England (1 Jul 1974).

Design and performance of He–Ne lasers stabilized by saturated absorption in I_2 are described. Locking to one of the absorption lines has been achieved with the third harmonic of the modulating frequency in the power output. Measurements of the harmonic content of the modulation frequency generator, the frequency tripler and the piezoelectric modulator are described. A simple electronic circuit, using a conventional stabilized laser, is presented which will notice or prevent eventual frequency jumps from one absorption line to another. Measurements of beat frequency and of frequency stability, characterised either by the power spectral density of the frequency fluctuations or by the Allan-variance are given. (Elect. Electron. Abstr.)

6272 CURRENT STATUS OF NBS LOW-POWER LASER ENERGY MEASUREMENT. West, E. D.; Case, W. E. (National Bureau of Standards, Boulder, CO). pp 98 of Conference on Precision Electromagnetic Measurements. London; Inst. of Electrical Engineers(1974).

From conference on precision electromagnetic measurements; London, England (1 Jul 1974).

A set of four electrically calibrated calorimeters is used at the Boulder Laboratories to test and calibrate devices for measuring laser powers in the energy range 0.03 to 10 J. Each of these calorimeters is separately subjected to an analysis of errors. (Elect. Electron. Abstr.)

6273 REPRODUCIBILITY OF 633 mm LASERS STABILIZED BY $^{127}I_2$. Wallard, A. J. (National Physics Lab., Teddington, Eng.). pp 106-107 of Conference on Precision Electromagnetic Measurements. London; Inst. of Electrical Engineers(1974).

From conference on precision electromagnetic measurements; London, England(1 Jul 1974).

The performance of the visible helium–neon laser stabilized, using third harmonic techniques, to a saturated absorption transition in iodine vapour is discussed. This technique involves audio modulation of the laser frequency and phase sensitive detection of the resulting laser intensity modulation at three times the modulation frequency. This results in a frequency control discriminant which is largely independent of the gain curve shape of the laser. (Elect. Electron. Abstr.)

6274 FREQUENCY STABILIZATION OF AN ARGON LASER BY SATURATED ABSORPTION OR DISPERSION IN IODINE AT 5145 Å. Borde, C.; Camy, G.; Vialle, J. L.; Decomps, B. pp 105 of Conference on Precision Electromagnetic Measurements. London; Inst. of Electrical Engineers (1974).

From conference on precision electromagnetic measurements; London, England(1 Jul 1974).

Preliminary experiments are described where a commercial argon laser is locked either to saturated dispersion or absorption lines. The advantage of the dispersion signal is to provide directly an error signal used to lock the laser frequency without any frequency modulation. The experimental set-up uses an external iodine cell inside a ring interferometer. According to the tuning of this interferometer one can get either an absorption or a dispersion signal. The limiting broadening mechanisms are discussed and experiments are in progress to study the resulting frequency stability. (Elect. Electron. Abstr.)

6275 MEASUREMENT OF THE STIMULATED EMISSION CROSS-SECTION IN CO_2-LASER BY FLUORESCENCE DROP TECHNIQUE. Grigoryants, V. V.; Zhabotinskii, M. E.; Semeikin, N. P. (Inst. of Radioengineering, Moscow). pp 319–321 of Conference on Precision Electromagnetic Measurements. London; Inst. of Electrical Engineers(1974).

From conference on precision electromagnetic measurements; London, England (1 Jul 1974).

The relation between the sidelight fluorescence drop and the effective stimulated emission cross-section for a cw CO_2 laser is discussed. Experimental results are presented and compared with published data. (Elect. Electron. Abstr.)

6276 NEW FREQUENCY MEASUREMENTS AND TECHNIQUES IN THE 30 TO 60 THz REGION. Whitford, B. G.; Siemsen, J. K.; Riccius, H. D.; Baird, K. M. (National Research Council, Ottawa). pp 233–234 of Conference on Precision Electromagnetic Measurements. London; Inst. of Electrical Engineers (1974).

From conference on precision electromagnetic measurements; London, England (1 Jul 1974).

Absolute frequency measurements in the 30 to 60 THz region are being made by the use of tungsten-nickel diodes. This paper reports on some novel techniques being tested and also reports new frequency measurements on $^{12}C^{16}O$ and $^{13}C^{16}O$ lasers. (Elect. Electron. Abstr.)

6277 ENERGY TRANSFER IN NOBLE-GAS MIXTURES: PENNING IONIZATION IN He/Xe. Shuker, R.; Szoeke, A.; Zamir, E.; Binur, Y. (Tel Aviv Univ., Israel). Phys. Rev., A.; 11: No. 4, 1187-1192(Apr 1975).

Following recent reports on strong uv and ir laser transitions in noble-gas mixtures, an attempt to determine the dominant precursor reactions leading to laser action was made. Experimental results of time-dependent spectroscopy of the various species existing in He/Xe mixtures excited by fast transverse electrical discharges are presented. Some parametric measurements of the He/Xe laser in the ir region are given. A plasma model is suggested for explaining the time behavior of the helium and xenon emissions. According to this model, which is justified by the experimental results, ir laser action in the He/Xe mixture is excited mainly by energy transfer from metastable helium atoms and molecules by Penning ionization of xenon atoms. (auth)

6278 SATURATION BEHAVIOR OF THE OPTICAL GAIN IN GaAs INJECTION LASERS. Lang, R. (Nippon Electric Co., Ltd., Kawasaki, Japan). IEEE J. Quant. Electron.; QE-10: No. 10, 825-826(Oct 1974).

A recent analysis of the saturation behavior of the optical gain in semiconductor lasers has predicted a strong spectral hole-burning effect. With an improved treatment of the intraband relaxation in the analysis the effect disappears entirely. (auth)

6279 CHEMICAL LASERS IN THE VISIBLE. Jones, C. R.; Broida, H. P. (Univ. of California, Santa Barbara). Laser Focus; 10: No. 3, 37-38; 40-41(Mar 1974).

Since the beginning of the laser era in 1960, a continuing search for chemical lasers has been carried out. This quest has been influenced by the knowledge that many chemical reactions produce visible chemiluminescence and, therefore, partition some of the reaction products into emitting, electronically excited states. Such luminescence has been observed not only from low-pressure, gas-phase reactions, notably those of alkali metals and halogens, but also from a limited number of liquid-phase reactions. (Elect. Electron. Abstr.)

6280 GAS LASERS AND APPLICATIONS. Hansen, C. F. (National Aeronautics and Space Administration, Moffett Field, CA). pp 47-58 of Proceedings of the 9th International Shock Tube Symposium. Stanford, CA; Stanford Univ. Press (1973).

From 9th international shock tube symposium; Stanford, CA (16 Jul 1973).

A brief review of laser elements is given. Flowing gas lasers are represented to have the best potential for high average power. The background of shock-tube researchers and the shock tube itself are alleged to be ideally suited for the development of such lasers. Three types--the electric discharge, the gasdynamic, and the chemical laser--are discussed briefly. A legion number of possible gas lasers is enumerated. With the development of their potential for higher power and efficiency, many additional and important uses of lasers are predicted, even beaming power through

space for long distances, up to 1 AU. A few details of some current high-power gasdynamic laser devices are given. (Elec. Electron. Abstr.)

6281 HIGH PRESSURE SHOCK TUBE DRIVEN GASDYNAMIC LASER. Klosterman, E. L.; Hoffman, A. L. (Mathematical Science Northwest Inc., Seattle). pp 156-166 of Proceedings of the 9th International Shock Tube Symposium. Stanford, CA; Stanford Univ. Press (1973).

From 9th international shock tube symposium; Stanford, CA (16 Jul 1973).

The conversion of a high pressure shock tube into a high powered gasdynamic laser is presented. At the 11,000 psi shock tube pressure capability, a mass flow of 50 kg/sec, a reflected shock temperature of 2000°K, and an ideal test time of 8.4 milliseconds are obtainable. At these conditions, an average laser power of approximately 400 kw can be extracted for four milliseconds. The performance of the device is discussed with particular emphasis on the redistribution of the shock heated laser gas from a four-inch diameter shock tube into a two-meter wide laser cavity. The laser power dependence on laser gas mixtures and cavity pressures, and the comparisons of experimental results to those predicted theoretically are presented. Also included is a discussion of the effects of the cavity flow aerodynamics on the optical quality of the beam. Two operational modes of the laser cavity are presented, namely quasi-steady operation, where energy is extracted for four milliseconds and natural time operation, where Q-switching the laser cavity results in a short (300 mu sec),-high powered (600 kw) pulse. (Elec. Electron. Abstr.)

6282 CATALYSIS IN SEALED CO_2 LASERS. Smith, A. L. S.; Browne, P. G. (Univ. of St. Andrews, Fife, Scotland). J. Phys., D (London); 7: No. 12, 1652-1659(11 Aug 1974).

The degree of dissociation of CO_2 in a sealed CO_2-N_2-He laser is limited by catalysis of reactions re-forming CO_2, either by a platinum cathode or with outgassed hydrogen. The degree of dissociation measured in a laser is in quantitative agreement with that calculated for the reactions occurring in the discharge plasma if 5% of the hydrogen is in the atomic form. The hydrogen partial pressure is controllable by a palladium diffusion tube. (Elect. Electron. Abstr.)

6283 PERTURBATION SPECTROSCOPY OF THE He–Cd LASER DISCHARGE. Browne, B. G.; Dunn, M. H. (Univ. St. Andrews, Fife, Scotland). J. Phys., B (London); 7: No. 10, 1113-1121(11 Jul 1974).

Chopping the radiation field in the cavity of a helium-cadmium laser operating at 4416 A induces perturbations in the populations of the $5s^2\ ^2D_{3/2,5/2}$ and $5p\ ^2P_{3/2}$ levels of Cd II. Analysis of the perturbations of the $5p\ ^2P_{3/2}$ and $5s^2\ ^2D_{5/2}$ populations shows that the ratio of non-radiative to radiative de-excitation rates for the upper laser level is 0.9 ± 0.2, approximately independent of discharge conditions. From the population changes of the $5s^2\ ^2D_{5/2}$ level the cross section for excitation from the $5s^2\ ^2D_{3/2}$ level by electron collisions is found to be $\sim 7 \times 10^{-16}$ cm^2 and the ratio of this cross section to that for excitation from the $5p\ ^2P_{3/2}$ level is 10^{-3}. (Elect. Electron. Abstr.)

6284 FREQUENCY SHIFTS IN A SINGLE-MODE LASER. Ahmad, F. (Univ. Manchester, Eng.). J. Phys., A (London); 17: No. 15, 1934-1943(11 Oct 1974).

The semi-classical laser equations are analyzed outside the rotating-wave approximation and a new exact steady-state solution for stationary but inhomogeneously broadened atoms is obtained. Results applicable to any solid-state laser are derived and these are also relevant to a gas laser working near threshold or at very high intensities. The resonance frequency exhibits a Bloch-Siegert shift. New results in the theory of frequency pulling and pushing are obtained. (Elect. Electron. Abstr.)

6285 MECHANISM OF TRANSVERSELY EXCITED CHEMICAL HBr LASER. Inoue, S. T. (Tokyo Univ.). Jap. J. Appl. Phys.; 13: No. 9, 1421-1428(Sep 1974).

The TE discharge in $H_2 + Br_2$ mixtures was applied to a chemical HBr laser. The laser pulses of the $P_3(4 \sim 6)$, $P_2(3 \sim 7)$, and $P_1(3 \sim 8)$ transitions were found in a cavity tuned to each transition. The integrated powers for the P_3 and P_2 laser transitions were nearly constant in a mixture of Br_2 with a pressure of $10 \sim 30$ torr and H_2 with a pressure of 100 torr. In contrast, the power for the P_1 transition becomes higher by increasing the Br_2 pressure up to 30 torr. This result is attributable to the fact that Br_2 or Br deactivates HBr in higher levels to $v = 1$. A calculation of the laser gain in terms of the chemical reaction and the vibrational relaxation supports this conclusion with a result that the V-R, T energy transfers are dominant processes rather than the V-V transfers when the pressure of HBr formed chemically is less than 0.2 torr. (Elect. Electron. Abstr.)

6286 POPULATION OF SOME EXCITED STATES OF SINGLY IONIZED ARGON IN AN ARGON LASER DISCHARGE. Ross, J. N. (Univ. of St. Andrews, Fife, Scotland). J. Phys., D (London); 7: No. 10, 1426-1433(1 Jul 1974).

The population densities of the $3d\ ^4F_{3/2,5/2,7/2,9/2}$, $3d\ ^4D_{3/2,5/2}$ and $4s\ ^4P_{1/2,3/2,5/2}$ levels of ionized argon in an argon ion laser discharge have been measured by a line absorption technique. The populations of these levels show a linear increase with discharge current. An estimate of the pumping rate of the upper laser configuration (4p) by electron collision with these 3d and 4s levels indicates that this may be an important, perhaps a dominant process in populating the 4p configuration. (Elect. Electron. Abstr.)

6287 CALCULATION OF THE INFRARED EMISSION OF A CO_2 LASER MEDIUM. Bihl, S.; Fouassier, J. P.; Joeckle, R. (Inst. of Franco-Allemand Recherches, Saint-Louis, France). J. Quant. Spectrosc. Radiat. Transfer.; 14: No. 9, 819-827(Sep 1974). (In French).

Vibrationally-excited CO_2 present with inverted population emits infrared radiation at 4.26 μm. For an emitter consisting of optically-thick isolated lines, calculations allow determination of the emissivity and radiancy of a homogeneous layer of gas. Infrared emission is a useful tool for measurement of the energy contained in the upper laser level. A very thin layer of cold gas strongly alters the spectral distribution of the intensity and causes the total radiancy to decrease. (Elect. Electron. Abstr.)

6288 ANALYSIS OF A SOFT-X-RAY LASER WITH CHARGE-EXCHANGE EXCITATION. Louisell, W. H. (Univ. of Arizona, Tucson); Scully, M. O.; McKnight, W. B. Phys. Rev., A.; 11: No. 3, 989-1000(Mar 1975).

A soft-x-ray laser utilizing electron pickup by a stripped nucleus is proposed. A particular example using electron exchange between hydrogen and an alpha particle is analyzed and is shown to produce inversion between the He_2^+/sub p/ and He_2^+/sub s/ levels giving stimulated emission at 304 A. In this scheme the alpha particles are swept along the target at the speed of light. The cross sections involved in the electron pickup in a hydrogen target and subsequent collisional deexcitation are analyzed to ascertain the optimum target thickness for population inversion. Also the effects of atomic collisions on the stimulated-emission cross section are estimated (Doppler broadening). The dynamics of the beam including focusing and space-charge effects are discussed. The stimulated-emission cross sections for a gas and a solid thin-film target are calculated. For a 30-mA alpha-particle current and a 10-cm lasing length, gains of 1.1 and 50 are estimated. (auth)

6289 NOISE DUE TO RELAXATION OSCILLATIONS IN A CW ND:YAG LASER. Suzuki, T.; Ieiri, S. (NHK Broadcasting Science Research Labs., Tokyo). Jap. J. Appl. Phys.; 13: No. 8, 1331–1332(Aug 1974).

The mechanism by which relaxation oscillations are excited in a cw Nd:YAG laser has been clarified by the investigation of noise characteristics of a laser pumped by a Kr arc lamp. The influence of variations in the angle between the cavity mirror and end face of the rod on the noise is discussed. (Elect. Electron. Abstr.)

6290 MECHANICAL TUNING OF A SUPERRADIANT DYE LASER WAVELENGTH. Prasada Rao, T. A.; Seetharaman, N. (Indian Inst. of Tech., Madras). Jap. J. Appl. Phys.; 13: No. 8, 1329–1330(Aug 1974).

A simple method of mechanical tuning of a dye laser through its complete lasing bandwidth using a single concentration of the dye solution in a wedge-shaped cell is reported. Superradiant emission spectra of DTDC iodide in ethylene glycol has been observed, and stimulated Raman scattering in carbontetrachloride has been studied. The results are compared to those obtained by a more conventional method. (Elect. Electron. Abstr.)

6291 ULTRAVIOLET LASER OSCILLATIONS OF MULTIPLY IONIZED IONS IN Z-PINCH DISCHARGE. Hashino, Y.; Katsuyama, Y.; Fukuda, K. (Kyoto Univ.). Jap. J. Appl. Phys.; 13: No. 7, 1134–1144(Jul 1974).

Pulse laser oscillations from multiple ionized N, O and rare gases were observed in the ultraviolet region of Z-pinch discharge. The optimum value of gas pressure, oscillation time and its pressure dependence were examined for laser oscillations and it was found that oscillations from different ions occurred in the increasing order of ionization after the breakdown of discharge. The line ArII λ4765 Å showed an anomalous behavior. Calculations were made on two different models for ionization and excitation of plasma. The first model was concerned with ionization and excitation by thermal electrons during plasma concerned with ionization and excitation by thermal electrons during plasma compression, and the second one with direct excitation of laser oscillation by runaway electrons. The calculation based on the

former explained the temporal sequence of laser oscillations and that on the latter explained the anomalous behaviour of ArII λ4765 Å line. (Elect. Electron. Abstr.)

6292 FM MODE-LOCKING OF A He–Ne 3.39 μm LASER USING LARGE LOCKING SIGNAL. Konishi, S.; Kobayashi, T.; Sueta, T. (Osaka Univ.). Jap. J. Appl. Phys.; 13: No. 7, 1189–1190(Jul 1974).

Ultrashort optical pulses can be generated even from narrow-linewidth lasers by applying a large locking signal to the intracavity modulator if the lasers have high gain. The authors verified this with an experiment using a phase (FM) modulation applied to a He–Ne 3.39 μm laser which has a narrow linewidth and high gain. (Elect. Electron. Abst.)

6293 PARAMETRIC STUDY OF TE HF CHEMICAL LASERS. Obara, M.; Fujioka, T. (Keio Univ., Yokohama-shi, Japan). Jap. J. Appl. Phys.; 13: No. 6, 995–1000(Jun 1974).

An experimental study of TE HF chemical lasers using the mixtures of SF_6 as a fluorine donor and either H_2, CH_4 or C_4H_{10} as a hydrogen donor was parametrically performed at room temperature. It was found that when the maximum peak laser power was produced under the optimum condition the mean energy of electrons in the discharge was about 3 eV. This was independent of the interelectrode-gap length and the hydrogen donor used. The laser peak power is discussed as a function of the SF_6 H_2-donor mixing ratio, and the temporal behavior of the laser and the discharge current pulses is also discussed. (Elect. Electron. Abstr.)

6294 BACKSCATTERING IN RING RESONATORS. Andronova, I. A. Izv. Vyssh. Ucheb. Zaved., Radiofiz.; 17: No. 5, 775–777(1974). (In Russian).

This type of scattering determines the range and the frequency of captured reverse waves. An analysis is made of the amplitudes of forward and reverse waves in a ring laser resonator. (Elect. Electron. Abstr.)

6295 FAR-FIELD EMISSION PATTERNS OF SINGLE HETEROSTRUCTURE GaAs LASERS. Henshall, G. D.; Whitewaway, J. E. A. (Standard Telecommunication Labs. Ltd., Harlow, Eng.). Electron. Lett.; 10: No. 15, 326–327(25 Jul 1974).

The emission patterns of single heterostructure lasers have been calculated as a function of the refractive-index step between the p GaAs active region and the n GaAs substrate. The conclusions that higher n doping levels should produce better optical confinement and a wider far-field pattern are supported by experimental measurements, from which the refractive index can be deduced. (Elect. Electron. Abstr.)

6296 HIGH POWER MOLECULAR LASERS. Klejman, H. Elektronika (Warsaw); 15: No. 3, 97-101(1974). (In Polish).

Two types of lasers are discussed: Transverse Excitation Atmospheric pressure (T. E. A.) and gasodynamic with ultrasonic gas flow. Development history, operational principle, constructional parameters, and applications are outlined underlining advantages of high pressure TEA CO_2 and CO_2 + N2 lasers with thermal excitation. Technical specifications of TEA laser model 120 produced by American firm TRW and '600 Modules' series of Canadian Lumonic Research Ltd. are given. Operational principal and schematic diagram of CO_2 and N2 lasers are elaborated as an example of continuous radiation type lasers. (Elect. Electron. Abstr.)

6297 SPECTRAL CHARACTERISTICS AND INHOMOGENEITIES NEAR ACTIVE REGIONS OF DOUBLE-HETEROSTRUCTURE (GaAl)As–GaAs LASERS WITH STRIPE GEOMETRY CONFIGURATION. Iida, S.; Watanabe, Y. (Tokyo Shibaura Electric Co. Ltd., Kawasaki, Japan). Jap. J. Appl. Phys.; 13: No. 8, 1249–1258(Aug 1974).

It is shown experimentally that several types of spectra of double heterostructure (GaAl)As-GaAs lasers are connected with corresponding inhomogeneities in and around their active regions. Families of axial modes belonging to different transverse modes along the junction plane often show different axial mode spacings, indicating filamentary nature along the axial direction. This type of oscillation may be called 'quasi-filamentary'. Families of axial modes in one transverse mode were also observed, which arise from the mode selection effect associated with sharp changes of the thickness of the active layer. For some lasers, evidence is given that local boundaries rather than the heteroboundaries plan an essential role. The sustained pulsations having characteristics of the second outer mode locking are connected with saturable absorption which arises from the existence of nonuniformity in the active region. (Elect. Electron. Abstr.)

6298 MEASUREMENT OF GAS LASER CAVITY STABILITY. Chow, B. S K. (Kodak Printing Ltd., Coburg, Victoria, Australia). Opt. Commun.; 11: No. 3, 231-234(Jul 1974).

Interference fringes observed on a laser interferometer are found, under certain conditions, to undergo both periodic shifts and visibility variations. Such effects can account for the failure of holographic recording when using the laser. A simple theory based on laser cavity stability has been used successfully to explain the observations. A method to pre-determine precisely the laser warm-up time for a particular hologram recording is suggested. (Elect. Electron. Abstr.)

6299 COAXIAL GLASS FLASHLAMP AND DYE LASER SYSTEM. Konjevic, R.; Konjevic, N. (Inst. of Physics, Belgrade). Fizika (Zagreb); 6: No. 1, 61-65(May 1974).

A simple glass, coaxial flashlamp and dye laser system are described. Spectral characteristics of the flashlamp and the influence of the light converter to its emission spectrum are also reported. (Elect. Electron. Abstr.)

6300 INFLUENCE OF INHOMOGENEOUS DISTRIBUTION AND LIFETIME OF THE MINORITY CARRIERS ON THE TEMPERATURE DEPENDENCE OF THE THRESHOLD CURRENT IN EBP LASERS USING p-TYPE GaAs. Parui, D. P.; Rakshit, S.; Chakravarti, A. N. (University Coll. of Science and Tech., Calcutta). Int. J. Electron.; 36: No. 6, 773-777(Jun 1974).

The temperature dependence of the threshold current in electron-beam-pumped (EBP) lasers using p-type GaAs (2×10^{18} cm^{-3}) at 27 kV is theoretically determined, taking into account the inhomogeneous distribution and the temperature dependence of the lifetime of the excess carriers. The computed dependence is found to be in excellent agreement with the experimental observation. A comparison is then made of the result with results obtained under different assumptions to confirm positively that, in the study of the performance of these lasers, the above two features cannot be ignored. (Elect. Electron. Abstr.)

6301 TUNABLE DYE LASERS AND THEIR APPLICATION. I. Kuhl, J (Carl Zeiss, Oberkochen, Germany). Int. Elektron. Rundsch.; 28: No. 8, 153-156(Aug 1974).

The paper gives a detailed survey on the state of the art and feasible applications of tunable lasers, discussing their methods of excitation, classification, frequency selectivity, extension of tuning range, and application in spectroscopy, analysis of element traces, environmental measurements, holography, photochemistry, and isotope separation. (Elect. Electron. Abstr.)

6302 SPECTROSCOPIC PROPERTIES OF CRYSTALS OF $SrAl_4O_7$–Nd^{3+}. Kevorkov, A. M.; Kaminskii, A. A.; Bagdasarov, Kh. S.; Tevosyan, T. T.; Sarkisov, S. E. (Inst. Crystallography, Moscow). Inorg. Mater.; 9: No. 10, 1637-1638(Oct 1973).

Translated from Izv. Akad. Nauk SSSR, Neorg. Mater.; 9: No. 10, 1839-1840(Oct 1973).

Some fundamental spectroscopic and generational characteristics of a new laser based on strontium aluminate $SrAl_4O_7(SrO \cdot 2Al_2O_3)$ activated by Nd^{3+} ions are given. (Elect. Electron. Abstr.)

6303 SOME EXPERIMENTS WITH THE 4-m cw HCN LASER. Bicanic, D. D.; Dymanus, A. (Katholieke Univ., Nijmegen, Netherlands). Infrared Phys.; 14: No. 3, 153-163(Sep 1974).

The HCN laser is nowadays considered as one of the most promising sources of submillimeter radiation. The paper provides data on factors affecting the power output of a 4-m long HCN laser employing a Michelson output coupling. In addition, laser resonator interferometry for low Fresnel numbers is discussed, and the mode structure is confirmed experimentally. The paper is completed by transmission data of several materials, investigated by means of the HCN laser, at 337 μm, as well as the evaluation of some parameters pertinent to the performance of the beam splitter. (Elect. Electron. Abstr.)

6304 DEPENDENCE OF THE PHOTON LIFETIME IN GaAs JUNCTION LASERS ON LASER LENGTH. Biswas, S. N.; Kumar, N. (Bengal Engineering Coll., Howrah, India). Indian J. Pure Appl. Phys.; 11: No. 11, 855-856(Nov 1973).

The dependence of the photon lifetime in GaAs junction lasers on laser length is theoretically determined. It is found that the photon lifetime increases with cavity length in both solution-grown and diffused junction GaAs lasers at 77 and 300°K. (Elect. Electron. Abstr.)

6305 EFFECT OF ROTATIONAL RELAXATION ON THE SEQUENTIALLY Q-SWITCHED CARBON-DIOXIDE LASER TRANSITIONS. Patel, B. S. (Solid State Physics Lab., Delhi). Indian J. Pure Appl. Phys.; 12: No. 2, 129-132(Feb 1974).

The sequential Q-switching of the CO_2 laser transitions provides a method for studying the effect of the rotational relaxation on the lasing transitions. Under favorable situation, the fast rotational relaxation is found to transfer significant population to the neighboring transitions. Experimental observations indicate that the rotational relaxation rate increases with the increasing quantum number of the rotational states. Consequently, more transitions could lase when the Q-switching se-

quence starts from the transitions of higher P-value side as compared to that starting from the reverse side. (Elect. Electron. Abstr.)

6306 N_2O-N_2-He GASDYNAMIC LASER. Grin, Yu. I.; Testov, V. G. (Inst. of Radio Engineering and Electronics, Moscow). Sov. Phys.-Tech. Phys. (Engl. Transl.); 19: No. 7, 975-977(Jan 1975).

Translated from Zh. Tekh. Fiz; 44: No. 7, 1557-1558(Jul 1974).

Lasing is observed in a shock-heated mixture of N_2O, N_2, and He issuing through a nozzle into vacuum. The optimum composition of the mixture is 10% N_2O, 20% N_2, and 70% He. (auth)

6307 SINGLE FREQUENCY TRAVELLING WAVE LASER USING NEODYMIUM GLASS AND ACTIVE Q-SWITCHING. Bakhorin, V. A.; Korobkin, Yu. V.; Markin, A. S.; Prokhindeev, A. V. Zh. Eksp. Teor. Fiz., Pis'ma Red.; 19: No. 12, 758-761 (20 Jun 1974).

A method is proposed for constricting the emission spectrum in solid state travelling wave lasers employing active Q switching. A stable single frequency operating mode is achieved by applying the method to a neodymium glass laser. The prospects for the method in stabilizing the frequency of high power single frequency lasers are discussed. (Elect. Electron. Abstr.)

6308 ELECTRICALLY DRIVEN 200-JOULE LASER. Kovsh, I. B.; Sobolev, V. A.; Basov, N. G.; Danilychev, V. A.; Ionin, A. A. (Lebedev Inst. of Physics, Moscow). Sov. Phys.-Tech. Phys.; 18: No. 11, 1488-1491(May 1974).

Translated from Zh. Tekh. Fiz.; 43: No. 11, 2357-2363(Nov 1973).

A description of a pulsed CO_2 laser with a working volume of 10 liters is given. The active medium is typically a 1.5 : 1.4 mixture of CO_2 : N_2 : He at pressures up to 3 atms. Ionization is achieved by means of a multitube cathode electron gun. Parameters are measured for various gas mixtures. (Elec. Electron. Abstr.)

6309 EFFECT OF GAS PRESSURE ON LOW-FREQUENCY BEATS IN A He-Ne LASER. Andreeva, E. Yu.; Gulyaev, S. N.; Terekhin, D. K. Opt. Spectrosc.; 36: No. 2, 219-220(Feb 1974).

Translated from Opt. Spektrosk.; 36: No. 2, 379-381(Feb 1974).

Previous work on this subject is reviewed and additional experimental data obtained in the pressure range 0.6 to 3 torr are presented. Curves are given for variation of beat frequency with magnetic field at various pressures, as a function of relative lasing intensity, and as a function of detuning. All curves at 1 torr are typical for an inhomogeneously broadened line. At pressures ≥2 torr nonlinearity is suppressed and pulling becomes independent of pump and lasing frequencies. (Elec. Electron. Abstr.)

6310 MEGAWATT VUV XENON LASER EMPLOYING COAXIAL ELECTRON-BEAM EXCITATION. Bradley, D. J.; Hull, D. R.; Hutchinson, M. H. R.; McGeoch, M. W. (Imperial Coll. of Science and Tech., London). Opt. Commun.; 11: No. 4, 335-338(Aug 1974).

Three nsec laser pulses, of bandwidth 1.3 nm, are obtained from a 10 J, 600 keV coaxial diode electron-beam pumping arrangement. Uniform pumping, with a well defined cylindrical geometry, facilitates experimental investigation of the laser parameters. Gas heating limits the laser repetition rate. While mirror damage at present limits the peak power to ~1 MW, higher powers seem available. The addition of helium results in a drastic reduction of peak molecular xenon fluorescence. (Elec. Electron. Abstr.)

6311 CRYSTAL DEFECTS OF HETEROSTRUCTURES OF AlAs-GaAs SOLID SOLUTIONS AND EFFECT ON THE CHARACTERISTICS OF INJECTION LASERS. Druzhinina, L. V.; Bublik, V. T.; Dolginov, L. M.; Eliseev, P. G.; Kerbelev, M. P.; Osvenskii, V. B.; Pinsker, I. Z.; Shumskii, M. G. (Lebedev Inst. of Physics, Moscow). Sov. Phys.-Tech. Phys. (Engl. Transl.); 19: No. 7, 935-939(Jan 1975).

Translated from Zh. Tekh. Fiz; 44: No. 7, 1499-1506(Jul 1974).

X-ray structural studies have been carried out on epitaxial films of $Al_xGa_{1-x}As$ solid solutions and two-sided heterostructures prepared from them and used in injection lasers. The lattice constant of the $Al_xGa_{1-x}As$ solid solutions is measured as a function of the concentration and found to deviate significantly from the Vegard law. The AlAs lattice constant is found to be 5.6675 ± 0.0005Å. Rocking curves recorded for multilayer structures reveal a degradation of the crystal structure near heteroepitaxial boundaries. X-ray topography reveals defects in these regions, which are apparently due to a discontinuity in the lattice constant at the heteroepitaxial boundary. A study is made of the effect of the dislocation density in the GaAs substrate and in the structure itself on the characteristics of injection lasers prepared from two-sided heterostructures. Dislocations significantly degrade the laser characteristics (the threshold and efficiency) only at densities $N_d \gtrsim 10^5\ cm^{-2}$. A study is made of the effects of structural defects, the thickness of the active layer, and the doping level on the rate of the progressive degradation of injection lasers using two-sided heterostructures. The rate of increase in the threshold current due to the degradation increases in diodes with a thin active layer (thinner than 1 μ). Doping has essentially no effect on the degradation rate. (auth)

6312 POWER OUTPUT COUPLING IN A DYE LASER PUMPED BY A NITROGEN LASER. Ganiel, U.; Neumann, G. (Weizmann Inst. of Science, Rehovot, Israel). Opt. Commun.; 12: No. 1, 5-7(Sep 1974).

A simple model for the operation of a pulsed dye laser, transversely pumped by a nitrogen laser, is presented. The combined effect of the transmission of the laser output coupler, its distance from the dye cell and the saturated gain characteristics of the dye laser medium, on the operation of the laser are considered. Experimental results are interpreted in terms of this model. (Elect. Electron. Abstr.)

6313 RELIABLE HIGH AVERAGE POWER DYE LASER. Jethwa, J.;Schafer, F. P. (Max-Planck-Inst. Biophysikalische Chemie, Gottingen, Ger.). Appl. Phys.; 4: No. 4, 299-302(Sep 1974).

A flashlamp-pumped dye laser with an average output power of 6.6 W at 100 Hz repetition rate is described, which utilizes thyristors as switching elements instead of the normally used spark gaps. Using a simmering-mode operation of the flashlamps, no high voltage sparks are required to initiate the discharge even at low capacitor voltages. In this way the amplitude and time jitter of the laser output pulse are decreased and the life and reliability of the laser considerably increased. (Elec. Electron. Abstr.)

6314 LASING LINE SHAPES IN THE $3s_2-2p_4$ AND $2s_2-2p_4$ TRANSITIONS OF He-Ne LASER. Melekhin, G. V. Opt. Spectrosc.; 36: No. 2, 221-222(Feb 1974).

Translated from Opt. Spektrosk.; 36: No. 2, 382-385(Feb 1974).

Using experimental values of the relaxation constants for the transitions the powers of the 0.6328 and 1.1523 μm lines are computed as functions of lasting frequency and results are presented graphically. It is shown that the curves give the complex structure of the line shape which can be used for the stabilization of two-channel lasers. (Elec. Electron. Abstr.)

6315 DIVIDENDS OF DYE LASER RESEARCH. Hughes, R. S. Nav. Res. Rev.; 27: No. 3, 17-28(Mar 1974).

The principle and applications of the tunable dye lasers are outlined. Laser search and rescue system employing a nitrogen laser which excites the sea dye marker, an optically and electronically filtered detector and a three-sided spinning mirror is described. Investigation of three tuning techniques--the electromechanical, acousto-optical and electrooptical methods is outlined. The promising use of dye lasers in developing a computer memory addressing system is discussed and some optical memory applications are described. Most promising performances have been found with organic dyes of the coumarin family. (Elect. Electron. Abstr.)

6316 DISTRIBUTED FEEDBACK GaAs HOMOJUNCTION INJECTION LASER. Stoll, H. M.; Seib, D. H. (Aerospace Corp., Los Angeles). Appl. Opt.; 13: No. 9, 1981-1982(Sep 1974).

The construction and operation of a distributed feedback GaAs homojunction injection laser which can be an integrated optical laser are described. Output spectra above and below lasing threshold are given. (Elec. Electron. Abstr.)

6317 EFFECTS OF TRIPLET STATE LOSSES ON COHERENT PROPERTIES OF ORGANIC DYE LASERS. Schaefer, R. B.; Willis, C. R. (Boston Univ.). Phys. Lett.; 48A: No. 6, 465-466 (29 Jul 1974).

Using a full quantum mechanical approach the authors show that, as pumping is increased above threshold, n_{max}/σ^2 of the photon, distribution can decrease rather than increase. The relationship between this phenomena and intensity dependent triplet state losses is discussed. (Elect. Electron. Abstr.)

6318 FEASIBILITY OF THE γ-LASER. Dmitriev, V. F.; Shuryak, E. V. Zh. Eksp. Teor. Fiz.; 67: No. 2, 494-502(Aug 1974). (In Russian).

The possibility of producing an active medium for a γ laser by means of synchrotron-radiation pumping is discussed. The scheme is compared with that in which neutron pumping is employed. The kinetics of induced γ-radiation is considered. Some necessary preliminary experiments are discussed. (Elec. Electron. Abstr.)

6319 GENERATOR FOR HIGH-FREQUENCY Q-SWITCHING OF A LASER. Kolesov, G. V.; Lebedev, V. B.; Milovidov, V. L.; Orlov, V. S. Instrum. Exp. Tech.; 16: No. 5, 1436-1437(1973).

Translated from Prib. Tekh. Eksp.; 16: No. 5, 120-121(1973).

A generator circuit for producing voltage pulses of negative polarity having an amplitude of up to 20 kV and a rise time of 25 nsec is described. The length of the pulses can be controlled from 200 to 400 nsec for a repetition period of 5 to 15 μsec. The generator is designed to shape voltage pulses across a capacitive load amounting to tens of picrofarads and is used to obtain series of giant pulses during the time of one flash of the pumping lamp. (Elec. Electron. Abstr.)

6320 TWO-MODE OPERATION IN A RING LASER. Sokolov, V. A.; Fradkin, E. E. (Zhdanov State Univ., Leningrad, USSR). Sov. Phys.-Tech. Phys.; 18: No. 11, 1494-1498(May 1974).

Translated from Zh. Tekh. Fiz.; 43: No. 11, 2367-2374(Nov 1973).

The laser equations for the four-wave regime in the normal mode approximation are developed. The question of the two-mode regimes and stability is then considered followed by a treatment of the beat frequency in the synchronized regime. The main results are tabulated and compared with those of previous workers. (Elec. Electron. Abstr.)

6321 KGS-3: AN ELECTRON-BEAM-PUMPED GALLIUM ANTIMONIDE LASER. Kryukova, I. V.; Nikitina, T. F.; Petrushenko, Yu. V.; Akimov, Yu. A.; Burov, A. A.; Kovalenko, V. A.; Rodichenko, G. V.; Stepanov, B. M.; Yakovlev, V. A. Sov. J. Quant. Electron.; 4: No. 1, 62-64(Jul 1974).

Translated from Kvantovaya Elektron. (Moscow); 1: No. 1, 114-118(Jan 1974).

Electron beam excited stimulated emission in gallium antimonide at liquid nitrogen temperatures is reported for the first time. The efficiency of emission at 1.6μ was 30%. Operational parameters including power output and spectral characteristics under differing conditions are given. (Elec. Electron. Abstr.)

6322 PREPULSE ENHANCEMENT OF FLASHLAMP PUMPED DYE LASER. Ornstein, M. H.; Derr, V. E. (National Oceanic and Atmospheric Administration, Boulder, CO). Appl. Opt.; 13: No. 9, 2100-2114(Sep 1974).

The power output of a conventional flashlamp pumped dye laser is increased by an order of magnitude or more by initiating a low-energy discharge through the flashlamp just ahead of the main discharge. Some theory and circuit details are given together with the experimental results. (Elec. Electron. Abstr.)

6323 SIGN OF THE DIFFERENCE OF INTENSITIES OF COUNTER WAVES OF CIRCULAR LASERS. Blazhnov, B. A. Zh. Prikl. Spektrosk.; 22: No. 1, 131-13[illegible]Jan 1975). (In Russian).

A study was made of the difference of the intensities of counter waves in a circular laser operating in a regime of synchronization of the counter waves. It was shown that in the case of equally isotopic active media the sign of the difference of intensities is determined only by the sign of the rotation rate of the circular laser. In the case of natural mixtures of isotopes the sign and value of the difference of intensities depends also on the frequency difference of the generating modes with respect to the center of the amplification contour of the active medium and on the phases of the coupling coefficients of the counter waves. Graphs were given of the dependence of the intensity difference on the current of non-mutual elements, obtained in circular lasers with natural active media with various frequency differences both for single-mode and two-mode generation regimes. In the case of two-mode regime the resulting value of the intensity difference is a simple sum of the intensity difference of each of the modes. (tr-auth)

6324 EFFECT OF BOUNDARY CONDITIONS ON THE AMPLIFICATION OF THE ACTIVE MEDIUM OF GAS LASERS. Privalov, V. E.; Yudin, S. F. Zh. Prikl. Spektrosk.; 22: No. 1, 42-46(Jan 1975). (In Russian).

The spatial distribution and the size of the amplification of the active medium of a laser depends on the geometry of the discharge gap. Under zero boundary conditions the amplification change in tubes with cross section different from that of cylindrical tubes was formulated with consideration only of geometric factors of 20 to 30%. It is shown that with boundary conditions different from zero, resonance can occur. Two specific cross sections were examined. (tr-auth)

6325 EFFECT OF HYSTERESIS ON THE RANGE OF SINGLE-FREQUENCY GENERATION OF GAS LASERS. Voitovich, A. P.; Smirnov, A. Ya. Zh. Prikl. Spektrosk.; 22: No. 1, 47-51(Jan 1975). (In Russian).

Calculations were made of the effect of hysteresis on the range of the single-frequency generation of gas lasers with absorbing sections within the resonator. The calculations were made for the case where the difference of the unsaturated amplification and loss is greater than zero in the frequency region less than the intermode interval. It was shown that the presence of hysteresis caused the anticoincidence of the central frequencies of the amplification and absorption contours; the width of the region of generation of a single frequency depends on the direction of the scanning frequency of the resonator. Generation regimes are possible where during scanning in one direction only one frequency is generated, but in the other direction two frequencies are generated. The calculation results were confirmed experimentally on He-Ne lasers (λ = 1.15 μm) with Ne absorbing sections. The hysteresis effect found in the region of single-frequency generation and the location of the intensity peak must be considered in the fabrication of single-frequency lasers, stabilized at the intensity peak. They can also be used for obtaining data on the spectral properties of amplifying and absorbing media. (tr-auth)

Cryogenic and Superconducting Equipment and Devices

Refer also to abstracts 6545, 6555, 7267, 7298, and 7299.

6326 (AD-774881) NATO ADVANCED STUDY INSTITUTE: LARGE SCALE APPLICATION OF SUPERCONDUCTIVITY AND MAGNETISM. Hein, R. A. (Office of Naval Research (USA). London Branch Office). 26 Nov 1973. 14p. (ONRL-C-26-73). NTIS $3.00.

The NATO Institute was held from 5 to 14 September 1973. Approximately 110 participants from 14 countries attended. Principal subject matter covered was: dc machines and propulsion; transmission of electrical energy; high field magnet research and development; practical superconducting materials; high speed magnetic levitation and propulsion; present large scale applications of superconductors; ac machines and cryogenics. (auth)

6327 (AD-781503) INTERACTION BETWEEN TWO COUPLED COHERENT OSCILLATORS. Research and Development Technical Report. Iafrate, G. J.; Croft, M. (Army Electronics Technology and Devices Lab., Fort Monmouth, N. J. (USA)). Jun 1974. 28p. (ECOM-4227). NTIS $3.25.

The quantum dynamics for two coupled harmonic oscillators is presented. Using the coupled boson representation, the assumed problem is shown to be isomorphic with a perturbed angular momentum oscillator. The current operator is obtained and its associated expectation values with respect to the number states, coherent states (glauber states) and atomic coherent states are given. In the limit of weak coupling the results obtained using the coherent states are shown to manifest a Josephson phase relationship. (auth)

6328 (AD/A-001029) NOISE IN JOSEPHSON POINT CONTACTS WITH AND WITHOUT RF BIAS. Claassen, J. H.; Taur, Y.; Richards, P. L. (Office of Naval Research, Arlington, Va. (USA)). Aug 1974. Contract N00014-69-A-0200-1056. 15p. NTIS $3.25.

Point contact Josephson junctions operated as microwave mixers at 36 GHz show conversion gain and lower noise than cooled Schottky barrier diodes in the same application. The noise in such junctions with and without rf bias is explored both experimentally and theoretically. The noise power is found to be about a factor 2 above the thermal noise in the resistively shunted junction model. In contrast to previous reports, the inclusion of a shot noise term in the theory for no rf bias overestimates the observed noise substantially. (auth)

6329 (AD/A-002460) PROCEEDINGS OF THE 1973 WORKSHOP ON NAVAL APPLICATIONS OF SUPERCONDUCTIVITY HELD AT NAVAL RESEARCH LABORATORY, WASHINGTON, D. C. ON NOVEMBER 28-29, 1973. Nisenoff, M. (Naval Research Lab., Washington, D. C. (USA)). 30 Oct 1974. 180p. (CONF-731161-). NTIS $7.00.

From workshop on naval applications of superconductivity; Washington, District of Columbia, USA (28 Nov 1973).

A total of nineteen papers were presented describing various on-going programs in the uses of superconducting materials and devices in the following areas of potential application: (1) magnetometers and gradiometers for ASW sensors and for elf and hf antennas, (2) superconducting resonant circuits for hf applications, (3) mm and sub-mm radiation detectors, (4) superconducting motors and generators for ship propulsion systems, (5) superconducting solenoids for airborne minesweeping and underwater acoustic transducers. Reviews of the ONR contract research program in superconductivity and the NRL program in superconducting materials were also presented. (GRA)

6330 (AD/A-002495) JOSEPHSON JUNCTION AS A DETECTOR OF MICROWAVE AND FAR INFRARED RADIATION. Richards, P. L. (California Univ., Berkeley (USA). Dept. of Physics). Dec 1974. Contract N00014-69-A-0200-1056. 94p. NTIS $4.75.

This article reviews the present status of Josephson effect detectors of microwave and far-infrared radiation. It includes

an elementary exposition of the theory of the Josephson effect and a general discussion of equivalent circuits for real junctions, junction impedance, junction optimization, and junction noise. A detailed description is given of four devices which show promise of competing successfully with non Josephson effect devices. These are the bolometer, the video detector, the heterodyne detector with external local oscillator, and the parametric amplifier. A number of other devices are described in less detail. (GRA)

6331 (AD/A-002727) POTENTIAL COOLING METHODS FOR AN ELF SQUID. Final Report. Cox, J. E. (Naval Research Lab., Washington, D. C. (USA)). Oct 1974. 38p. (NRL-MR-2899). NTIS $3.75.

Current communication systems fall short of operational requirements and in addition impose undesirable restraints on submarines' operating flexibility. A new approach to the problem employs a superconducting magnetic field detector known as a superconducting quantum interference device (SQUID). However, present generation SQUIDS can operate only at temperatures in the the vicinity of 4.2°K. The most adverse potential configuration of the SQUID container is to have it towed from a submerged submarine. The possible cooling techniques for this system are storage dewars that will last for the duration of the cruise, liquid helium transfer from the submarine, and active mechanical refrigeration on the SQUID buoy. This report outlines the various refrigeration cycles, storage and transfer schemes, and finely a critique of the various systems accompanying a list establishing the most feasible methods for the task at hand. (GRA)

6332 (COM-74-11657) REFRIGERATION FOR AN 8 K TO 14 K SUPERCONDUCTING TRANSMISSION LINE. Daney, D. E. (National Bureau of Standards, Boulder, Colo. (USA)). Oct 1974. 61p. (NBSIR-74-375). NTIS $4.25.

The performance of three supercritical refrigeration cycles for cooling superconducting transmission lines has been investigated for the temperature range of 8 to 14°K. This temperature range is applicable to the Stanford superconducting (Nb_3Sn) line. These cycles, which were selected as being the most practical, are the Brayton cycle with the expander before the load, the Brayton cycle with the expander after the load, and the Brayton cycle with a separate supercritical helium loop and circulating pump. The results are presented as curves of W_c/Q (ratio of the work of compression to the refrigeration load) vs the transmission line exit pressure for various transmission line pressure and temperature drops. Contrary to popular belief, all three cycles are competitive. Maximum efficiencies (percent of Carnot) are about 25 percent. Estimated capital and operating costs are presented as a function of transmission line temperature for several values of thermal load per length of line. (GRA)

6333 SUPERCONDUCTING MAGNETS. II. Novak, Dezso (Nuclear Research Institute, Debrecen, Hungary). Fiz. Szemle; 24: No. 12, 362–372(Dec 1974). (In Hungarian).

Following up the first part on the properties of superconducting materials, their practical applications are discussed. The first superconducting magnets were prepared by using alloys and compounds of Nb and V. The compound Nb_3Sn exhibits the most favorable magnetic properties. It is used primarily in the form of a thin layer. Wires made of Nb–Zr and Ni–Ti alloys are sufficiently flexible after cold work that they may be fabricated in the form of coils. The ternary compound $Nb_3(Al_{0.8}Ge_{0.2})$ has promising properties. The technical difficulties encountered during practical applications, such as current degradation, training effect, and the methods used for stabilizing the coils, e.g., the enthalpy and cryostatic stabilization techniques, are examined. The most important step was the introduction of wires with internal stability in 1969. Present problems are not those of fundamental research but engineering and economic questions. (TTT)

6334 HYBRID MAGNETS. Hudson, P. A. (Oxford Univ.). Phys. Bull. (London); 26: 57(Feb 1975).

The research need for magnets having fields greater than the present largest available at the Clarendon Laboratory, 8T, and extending over an adequate volume of space, is stressed. Possible methods of obtaining such a magnet are outlined. The design chosen is a combination of resistive and superconductive windings forming a "hybrid" magnet, the resistive solenoid operating in the bore of a large annular Dewar housing a superconductive winding. Details of design are given and technical problems disdiscussed. In preliminary tests both magnets have achieved design performance and it is hoped that routine operation at 16T will be possible shortly. (UK)

6335 DOWNWARD FREQUENCY CONVERSION AT AN EXTERNALLY PUMPED SUPERCONDUCTING POINT CONTACT. Gubankov, V. N.; Likharev, K. K. Radio Eng. Electron. Phys. (USSR) (Engl. Transl.); 19: No. 3, 92–97 (Mar 1974).

Translated from Radiotekh. Elektron.; 19: No. 3, 583–589 (Mar 1974).

The conversion coefficient and noise temperature are calculated for a down converter, employing a superconducting point contact, for the case of an external pump signal (heterodyne). (auth)

6336 CONTROL OF THE BEHAVIOR OF TWO COUPLED-SUPERCONDUCTING COILS DURING A QUENCH. Bret, J. L.; Develey, G.; Faure, J. P.; Vallier, J. C. (Centre National de la Recherche Scientifique, 38-Grenoble (France). Centre de Recherches sur les Tres Basses Temperatures). Rev. Phys. Appl.; 9: No. 5, 931–937(Sep 1974). (In French).

In some superconducting coils producing high magnetic fields, the magnetic energies brought into play are sometimes important enough to damage these coils during a transition. For a set of two magnetically connected superconducting electromagnets, a simple process is described which avoids any damage through heating during a quench. (FR)

Heat Transfer and Fluid Flow

Refer also to abstracts 6362, 7875, 8074, 8216–8218, 8303, 8314, and 8315.

6337 (CONF-750413-P2, pp IV.23-IV.38) FINITE ELEMENT ANALYSIS OF VISCOUS, INCOMPRESSIBLE FLUID FLOW. Gartling, D. K. (Sandia Labs., Albuquerque, NM); Becker, E. B. 1975. From ANS computational methods in nuclear energy; Charleston, South Carolina, USA (15 Apr 1975).

In proceedings of the conference on computational methods in nuclear engineering. Vol. II. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.; Energy Research and Development Administration, Aiken, S. C. (USA). Savannah River Operations Office).

A numerical procedure was developed for the analysis of general two-dimensional flows of viscous, incompressible fluids, using the finite element method. The partial differential equations describing the continuum motion of the fluid were discretized by using an integral energy balance approach in conjunction with the finite element approximation. The nonlinear algebraic equations resulting from the discretization process were solved, using a Picard iteration technique. A number of computational procedures were developed that allowed significant reductions to be made in the computational effort required for the analysis of many flow problems. These techniques include a coarse-to-fine-mesh rezone procedure for the detailed study of regions of particular interest in a flow field and a special finite element to model far field regions in external flow problems. The formulation of the basic discrete problem is given in the next section, followed by a discussion of a simple but effective solution algorithm in the third section. The fourth and fifth sections present the development of a coarse-to-fine-mesh rezone procedure and a special finite element for use in external flow problems. (auth)

6338 (FEI-455) STUDY OF THE MEAN HYDRODYNAMIC CHARACTERISTICS OF THE TURBULENT FLOW IN A RECTANGULAR CHANNEL. Subbotin, V. I.; Ushakov, P. A.; Levchenko, Yu. D.; Gabrianovich, B. N.; Boltoev, Yu. D.; Ukhov, V. A.; Titov, Yu. G. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1973. 43p. (In Russian). INIS.

Results are presented of an experimental study of velocity fields and hydraulic resistance for flow in a channel of rectangular cross-section with a ratio of sides of 8:1. The channel models the flow between infinite parallel plates. Measurements of velocity profiles were carried out in the range of Reynolds numbers from 80,000 to 46,000. Local velocities were measured up to the laminar layer at the wall. The hydraulic resistance between the parallel plates is 4 to 6% higher than the data for circular tubes. A description is given of the measurement technique and construction of the experimental channel. (tr-auth)

6339 (WANL-TMI-1722) GENERAL LOSS COEFFICIENT PROGRAM. Jacob, W. L. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 22 May 1967. 45p. Dep. NTIS $5.25.

The LOSCOF program contains the equations and/or stores in core, tables for the necessary thermodynamic properties of argon, air, hydrogen, and helium. It provides for the experimenter the freedom to set up his own titular information. A standard output data header format is available; however, the program user has the option to rename a selected group of data headers. Data from pressure measurements can be input in any of the standard units of pressure (psig, inch of Hg, or inch of water) as long as consistancy is maintained. For example: the program would require re-initiation if the upstream orifice pressure measurement would be changed from inches of water to inches of mercury. For practical purposes the program is without limit

in regards to quantity of data and it has an option for non-redundant data input when multiple coefficients are determined for the same flow rate. The loss coefficient impedance areas can be of any geometry. Either a standard ASME orifice or a sonic orifice can be used for flow measurement. The program prints out a standardizing pressure (i.e., rig inlet), the impedance upstream pressure and pressure drop, the isothermal temperature, gas density and gas viscosity at the upstream loss coefficient station, the gas flow rate, loss coefficient, and Reynolds number. (auth)

6340 AN APPROXIMATE EXPRESSION OF HEAT TRANSFER COEFFICIENT BY TRANSIENT HEAT CONDUCTION. Sakurai, A.; Mizukami, K. (Kyoto Univ., Uji (Japan). Inst. of Atomic Energy). Tech. Rep. Inst. At. Energy, Kyoto Univ.; No. 155, 1-12(Mar 1972).

An approximate but simple formula which describes the heat transfer coefficient by transient heat conduction caused by time-dependent heat generation is proposed. The heat transfer coefficient is expressed as a function of the reduced time. The accuracy of the formula is examined for the system which consists of a plate heater and surrounding solid and for some transiencies of heat generation rate. It is concluded that by the use of this formula the heat transfer coefficient can be predicted with an accuracy within 15% over the whole range of time for any non-decreasing variation in heat generation rate without solving the transient heat conduction equations. The accuracy in practical application of this approximate method to the reactor safety analysis will be improved since the accuracy, ±15%, represented above results from emphasizing the general treatment of the variation in heat generation with time. (auth)

6341 STABILITY OF A LIQUID FILM IN A COUNTER-CURRENT ANNULAR TWO-PHASE FLOW. Mainly on a Critical Heat Flux in a Two-Phase Thermosyphon. Kusuda, H.; Imura, H. (Kumamoto Univ. (Japan). Faculty of Engineering). Nippon Kikai Gakkaishi; 40: No. 332, 1082-1088(Apr 1974). (In Japanese).

Counter-current annular two-phase flow occurs in wet wall towers and in up-draft condensers. The critical velocity of flow, which makes the flow stable, is called flooding velocity. In annular two-phase flow, the state of liquid film is stable just before flooding effect occurs. As soon as the conditions of flooding occurrence are attained, the amplitude of wave surface of the liquid film increases and the waves on opposite sides are bridged. Because of the bridge between waves, the liquid film is forced into the reverse direction by opposite flowing gas so that the supply of liquid to heating surface stops, and dry out phenomenon occurs. A formula for treating critical velocity based on the instability of liquid film is reported. Also the treatment of critical heat flux in boiling thermosyphon was attempted, and the traditional studies on the flooding velocity in wet wall towers were investigated. By using the formula, the data on the critical heat flux in boiling thermosyphon were investigated and the result was rather satisfactory. (JA)

6342 INVESTIGATION OF THE COLLAPSE AND SURFACE REWET IN FILM BOILING IN FORCED VERTICAL FLOW. Iloeje, O. C.; Plummer, D. N.; Rohsenow, W. M.; Griffith, P. (Massachusetts Inst. of Technology, Cambridge). J. Heat Transfer; 97: No. 2, 166-172(May 1975).

A transient boiling experiment has been run in such a way that one can acquire data in forced convection film, transition, and nucleate boiling regions for a specified pressure, quality, and mass flux. Transient boiling experiments were conducted at the Nuclear Energy Division of the General Electric Company for water in a 0.492 in. ID inconel X-750 tube at mass fluxes of 50,000, 100,000, and 250,000 lbm/hr-ft^2, quality range of from 30 to 100 percent and a pressure of 1000 psia. The reduced boiling curves for these data indicated temperature differences at burnout on the order of from 100 to 200^{0}F and temperature differences at the minimum ranging from 700 to 1100^{0}F. These results (higher than in other experiments) are felt to be caused by scale deposit, axial conduction, and roughnesses on the test surface. Physical evidence indicates that the test surface became coated with an appreciable scale deposit when subjected to the initial temperatures in excess of 1500^{0}F in a steam atmosphere. It has been found that BWR fuel will normally have scale deposit on the heat transfer surface and thus the qualitative effects of scale deposits in this report are expected to apply in BWR Loss-of-Coolant accident evaluation. An empirical correlation was developed for the data for minimum film boiling temperature differences. The correlation was based on Berenson's minimum pool film boiling temperature difference correlation in order to provide a technique for extrapolating to different pressures. (auth)

6343 INFLUENCE OF THE THICKNESS AND THERMAL PROPERTIES OF HEATING WALLS ON THE HEAT TRANSFER COEFFICIENTS IN NUCLEATE POOL BOILING. Magrini, U.; Nannei, E. (Istituto di Fisica Tecnica e Impianti Termotecnici, Genoa). J. Heat Transfer; 97: No. 2, 173-178(May 1975).

An experimental investigation was conducted under conditions of saturated pool boiling of water at atmospheric pressure on thin, horizontal, cylindrical walls of different metals and thicknesses, electrically heated. The heating walls, ranging in thickness from 5 to 250 mu m, were obtained by plating copper, silver, zinc, nickel, and tin on nonmetallic rods. Experiments showed that the heat transfer coefficient can be affected, in particular conditions, by the heating wall thickness. In particular, it resulted that the smaller the thermal conductivity of the metal layer, the higher the influence of the thickness. A semiempirical correlation of the form DELTA T equals (q/A)/sup n/f(kappa d, root kappa rho c) suitable to correlate the experimental data within +-15 percent in the whole range of variables here investigated is proposed. (auth)

6344 AXIAL HEAT CONDUCTION EFFECTS IN FORCED CONVECTION ALONG A CYLINDER. Chen, T. S.; Lohman, M. E. (Univ. of Missouri, Rolla). J. Heat Transfer; 97: No. 2, 185-190 (May 1975).

An analytical study is performed to determine the effects of axial heat conduction and transverse curvature on laminar forced convective heat transfer of liquid metals along a circular cylinder. The flow and thermal boundary layers for this problem are non-similar, the non-similarity arising both from the transverse curvature xi equals (4/R) (nu x/u/sub infinity)/sup ½/ of the cylindrical surface and from the axial heat conduction effect expressible as OMEGA equals 1/Pe/sub x/, where Pe/sub x/ is the local Peclet number. The governing equations are solved by the local nonsimilarity method in which all the terms in the conservation equations are retained and only terms in the derived subsidiary equations are selectively deleted according to the levels of truncation. Numerical results are presented for liquid metals having representative Prandtl numbers of 0.03, 0.008, and 0.003 over a wide range of xi values from 0 (i.e., a flat plate) to 4.0 and OMEGA values from 0 (i.e., without axial heat conduction effect) to 0.20. The results indicate that the local surface heat transfer rate increases with an increase in the transverse curvature of the cylindrical surface, an increase in Prandtl number, and an increase in the axial heat conduction parameter or a decrease in Peclet number. (auth)

6345 NATURAL CONVECTION IN A HORIZONTAL FLUID LAYER WITH VOLUMETRIC ENERGY SOURCES. Kulacki, F. A.; Nagle, M. E. (Ohio State Univ., Columbus). J. Heat Transfer; 97: No. 2, 204-211(May 1975).

Natural convection with volumetric heating in a horizontal fluid layer with a rigid, insulated lower boundary and a rigid, isothermal upper boundary is experimentally investigated for Rayleigh numbers from 114 to 1.8 x 10^5 times the critical value of linear stability theory. Joule heating by alternating current passing horizontally through the layer provides the volumetric energy source. Layer aspect ratios are kept small to minimize the effects of side walls. A correlation for mean Nusselt number is obtained for steady heat transfer, and data are presented on fluctuating temperatures at high Rayleigh numbers and on developing temperature distributions when the layer is subjected to a step change in power. (auth)

6346 ANALYTICAL INVESTIGATION OF FORCED CONVECTION HEAT TRANSFER TO FLUIDS NEAR THE THERMODYNAMIC CRITICAL POINT. Sastry, V. S. (Tennessee State Univ., Nashville); Schnurr, N. M. J. Heat Transfer; 97: No. 2, 226-230(May 1975).

A numerical solution is carried out for heat transfer to fluids near the thermodynamic critical point for turbulent flow through a circular tube with constant wall heat flux. An adaptation of the Patankar-Spalding implicit finite difference marching procedure is used. Agreement of the results with experimental data for water and carbon dioxide show the solution to be quite accurate very near the critical point provided the wall temperature at inlet is less than the pseudocritical temperature of the fluid. (auth)

6347 PHENOMENOLOGICAL TURBULENCE MODEL AND ITS APPLICATION TO HEAT TRANSPORT IN INFINITE ROD ARRAYS WITH AXIAL TURBULENT FLOW. Ramm, H.; Johannsen, K. (Institut fuer Kerntechnik, Berlin). J. Heat Transfer; 97: No. 2, 231-237(May 1975).

The "turbulence-model" approach has been applied to solve the Reynolds equations of momentum and energy for an incompressible, steady-state, one-directional, hydrodynamically fully developed, turbulent internal flow. To close the turbulence equations, a phenomenological model of turbulent motion and energy transport has been developed which includes anisotropy effects. Predictions made for the turbulent diffusivities of heat in turbulent flow in a plain tube are found to be in good agreement with the experimental data over a wide range of Reynolds and Prandtl numbers. Corresponding results for infinite rod arrays with in-line flow also compare favorably with the few reliable data available. (auth)

6348 PREDICTION OF LOCAL AND INTEGRAL TURBULENT TRANSPORT PROPERTIES FOR LIQUID-METAL HEAT TRANSFER IN EQUILATERAL TRIANGULAR ROD ARRAYS. Ramm, H.; Johannsen, K. (Institut fuer Kerntechnik, Berlin). J. Heat Transfer; 97: No. 2, 238-243(May 1975).

A theoretical method based on a phenomenological turbulence model has been applied to evaluate turbulent transport properties for liquid-metal heat transfer in bare equilateral triangular rod bundles. Results obtained for local distributions of thermal eddy diffusivity in the various directions are presented in terms of correlations. From a subsequent solution of the three-dimensional heat transfer problem between two characteristic interior subchannels under conditions characteristic for tracer-type mixing experiments, integral thermal mixing coefficients and thermal length scales have been evaluated. Results demonstrate that the basic concept of subchannel analysis treating molecular conduction and turbulent transport independently of each other tends to underestimate intersubchannel transport. The uncertainties which are involved in principal assumptions of the turbulence-model as well as in the available empirical results are discussed in some detail. (auth)

6349 SOME PECULIARITIES OF TWO-PHASE FLOW IN NOZZLES. Starkov, V. K.; Sternin, L. E.; Tishin, A. P.; Khudyakov, V. A. Fluid Dyn.; 8: No. 3, 384-390(1973).

Translated from Izv. Akad. Nauk SSSR, Mekh. Zhidk. Gaza; 8: No. 3, 50-57(1973).

Calculations are conducted for unidimensional two-phase flow in nozzles for a wide range of particle concentrations and dimensions. It is established that there exists a maximum in loss of specific momentum due to a lag in particle velocity and temperature relative to the gas. The results obtained are compared with calculations using linearized theory as well as with experimental data. The agreement between calculation and experiment is noted. Equilibrium flow of a two-phase mixture with solidification of liquid particles is considered. The presence of an anomalous flow region is established, where in the model of an ideal unidimensional equilibrium flow in a nozzle with discharge into a vacuum the presence of two successively located minimum sections is necessary. (auth)

6350 CALCULATION OF THE INITIAL THICKNESS OF A MICROLAYER WITH NUCLEATE BOILING. Smirnov, G. F. (Odessa Technological Inst.). Inzh.-Fiz. Zh.; 28: No. 3, 503-508(Mar 1975). (In Russian).

An approximate model for calculating the initial thickness of the liquid microlayer with vapor volume growth near the solid wall is proposed. This model was used for different specific cases: pool boiling in a capillary, boiling in narrow horizontal channels. The calculation results are in agreement with some literature data. (auth)

6351 NUMERICAL CALCULATION OF MULTIPHASE FLUID FLOW. Harlow, F. H.; Amsden, A. A. (Los Alamos Scientific Lab., NM). J. Comput. Phys.; 17: No. 1, 19-52 (Jan 1975).

A new computing technique is described for the solution of fluid flow problems in which several fields interpenetrate and interact with each other. An implicit coupling for each field between mass transport and equation of state allows for calculations in all flow-speed regimes, from far subsonic (incompressible) to far supersonic. In addition, the momentum transport between fields is implicit, allowing for all degrees of coupling, from very loose to completely tied together. Phase transitions permit interchange of mass, momentum and energy between fields, each of which is composed of several components. Considerable generality is present, to present, to permit application to a wide scope of complicated problems, for example, the fluidized dust bed, the flow of a liquid with the fall of precipitation. (auth)

6352 TRUE GAS CONTENT OF VERTICAL ADIABATIC TWO-PHASE FLOWS UNDER LOW PRESSURE AND VACUUM. Tkachenko, S. I. Inzh.-Fiz. Zh.; 28: No. 3, 410-416(Mar 1975). (In Russian).

The system of the parameters for phase slip is specified. On the basis of the system specified, the data on true gas content of low and high viscous flows in the vertical tubes and annular channels D_{eq} = 6 to 1000 mm under low pressure and in vacuum are generalized. (auth)

Materials Testing

Refer also to abstracts 7055 and 7067.

6353 (AED-CONF-74-538-051) INSPECTION AND EXPLOSIVE WELD PLUGGING OF DEFECTIVE TUBING IN A FERRITIC HEAT EXCHANGER. Watkins, B.; Dickinson, F. S. (United Kingdom Atomic Energy Authority, Risley). 1974. 4p. INIS.

From 2nd international colloquium on welding in nuclear engineering; Duesseldorf, F. R. Germany (23 Oct 1974).

6 figs.; 1 ref. With abstract in German. Available from ZAED.

Methods of inspection for visual eddy current and needle measurements on the depth of the defect are described and details on the calibration and correlation are given. The explosive weld plugging and the inspection process to test the basic measures and the improved tubes are described. (auth)

6354 (AERE-R-7946) REVIEW OF CURRENT ULTRASONIC NONDESTRUCTIVE TESTING DEVELOPMENTS IN THE UNITED KINGDOM. Curtis, G. J. (UKAEA Research Group, Harwell. Atomic Energy Research Establishment). Feb 1975. 25p. Dep. NTIS (US Sales Only) $4.25. UK 50 pence.

The current direction being taken by ultrasonics research in nondestructive testing is towards determination of defect significance. In any given situation, the significance of a defect is a question for fracture mechanics to solve. Inevitably, however, the solution will contain some reference to defect position, size, shape and orientation. The purpose of the paper is to review some of the techniques currently under investigation which, it is hoped, will aid the nondestructive assessment of some or all of these parameters. The techniques are the direct visualization methods of Schlieren, photoelasticity, holography, and automated "B" and "C" scanning; the indirect methods of spectroscopy, pulse attenuation and acoustic emission. As attempts at quantization stand or fall on knowledge of transducer performance, some space is given to transducer development and behavior assessment. (auth)

6355 (CEA-CONF-2775) LOCALIZATION OF ACOUSTIC EMISSION SOURCES. Chretien, N. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Technologie). Jul 1974. 9p. (In French). INIS.

From session for improvement in the field of acoustic emission nondestructive testing; Lyon, France (16 Sep 1974).

The determination of the position for acoustic emission sources results from a specific processing of the signals provided by several sensors fastened on a structure submitted to mechanical or thermal stresses. The various steps for calculating the source coordinates are given on a scheme. This type of signal processing is envisaged in the continuous monitoring of pressure vessels for nuclear reactors. (auth)

6356 (GEPP-144) ULTRASONIC TESTING OF ELECTRON BEAM CLOSURE WELD ON PRESSURE VESSEL. Andrews, R. W. (General Electric Co., St. Petersburg, Fla. (USA). Neutron Devices Dept.). 16 May 1975. Contract AT(29-2)-656. 12p. Dep. NTIS $4.00.

One of the special products manufactured at the General Electric Neutron Devices Department (GEND) is a small stainless steel vessel designed to hold a component under high pressure for long periods. The vessel is a thick-walled cylinder with a threaded receptacle into which a plug is screwed and welded after receiving the unit to be tested. The test cavity is then pressurized through a small diameter opening in the bottom and that opening is welded closed. When x-ray inspection techniques did not reveal defective welds at the threaded plug in a pressured vessel, occasional "leakers" occurred. With normal equipment tolerances, the electron beam spike tends to wander from the desired path, particularly at the root of the weld. Ultrasonic techniques were used to successfully inspect the weld. The testing technique is based on the observation that ultrasonic energy is reflected from the unwelded screw threads and not from the regions where the threads are completely fused together by welding. Any gas pore or any threaded region outside the weld bead can produce an echo. The units are rotated while the ultrasonic transducer travels in a direction parallel to the axis of rotation and toward the welded end. This produces a helical scan which is converted to a two-dimensional presentation in which incomplete welds can be noted. (auth)

6357 (SAA-DR-75037) AUSTRALIAN STANDARD METHODS FOR THE RADIOGRAPHIC EXAMINATION OF FUSION WELDED BUTT JOINTS IN STEEL (METRICATION AND REVISION OF AS B164-1965). (Standards Association of Australia, North Sydney). 15 Mar 1975. 21p. Dep. NTIS (US Sales Only) $4.25.

This standard sets out methods for the radiographic examination of fusion welded joints in steel by the use of x-rays or gamma rays. Methods described are based on procedures in which the film lies parallel and adjacent to one surface of the weld and the source of radiation is on the remote site of the weld and at some distance from it. (auth)

6358 DYNAMIC NONDESTRUCTIVE INSPECTION USING THERMAL NEUTRONS. Rose, P. J.; Jacobs, A. M.; Kenney, E. S. (Pennsylvania State Univ., University Park). Nucl. Technol.; 26: No. 1, 101-106(May 1975).

Dynamic nondestructive inspection of optically opaque systems can be accomplished using a dynamic radiography technique with thermal neutrons as the illuminating radiation. Dynamic radiography correlates the useful information in scattered radiation from vibrating objects. The information generally takes the form of three-dimensional frequency spectra profiles. Such data give the mechanical condition of objects. Thermal-neutron scattering from eccentrically rotating plastic pegs shows that single-point system correlation sensitivity can indicate the presence of pegs $^1/_{16}$ in. in diameter. Pulsed polyethylene cube experiments emphasize the effects of object nonrigidity on correlation to show how sensitive dynamic-neutron radiography is to changes in the mechanical quality of nonrigid hydrogenous materials. (auth)

Nuclear Explosions

Refer also to abstract 6666.

6359 (BM-IC-8425) POTENTIAL APPLICATIONS FOR NUCLEAR EXPLOSIVES IN A SHALE-OIL INDUSTRY. Williams, F. E.; Russell, P. L.; Sheridan, M. J. (Bureau of Mines, Denver, Colo. (USA). Denver Mining Research Center). 1969. 37p. Dep. NTIS $5.00.

Nuclear detonation data were accumulated, studied, and evaluated by the Bureau of Mines to visualize how nuclear explosives might be used in a shale-oil industry. The evaluation shows that the Green River Formation at the semi-isolated locale of Piceance Creek Basin, in northwestern Colorado, is thick and widespread enough to warrant consideration of nuclear mining in lieu of conventional methods. Because cost data for nuclear explosions are limited, cost comparisons are made largely by assumptions. Also described are the history of the shale-oil industry, the geology and size of oil-shale resources, and conventional mining methods and processing technology. (auth)

6360 (COO-1156-76) ENVIRONMENTAL IMPACTS ASSOCIATED WITH PROJECT RIO BLANCO. Alldredge, A. W.; Whicker, F. W.; Hanson, W. C. (Colorado State Univ., Fort Collins (USA). Dept. of Radiology and Radiation Biology). [nd]. 24p. Dep. NTIS $4.25.

Project Rio Blanco, an experiment involving deep underground detonation of three 30-kton nuclear explosives designed to stimulate natural gas flow in geologic formations of low permeability, was conducted in western Colorado on 17 May 1973. Environmental impacts associated with this experiment were divided into three categories: radiation, ground motion, and conventional physical activities. Radiation and ground motion are unique to this type experiment while conventional activities would be associated with any type of resource development. The objective of observations made at Rio Blanco was to qualitatively and, where possible, quantitatively ascertain environmental impacts associated with the project. Observations indicated that ground motion and conventional activities appeared to cause the greatest impacts. Ground motion impacts were most severe within 2.4 km of the emplacement well (EW) and were predominantly associated with steep ravine and stream banks and rocky cliffs. Following the detonation, flow and turbidity had increased in a small stream adjacent to the EW. Animals receiving deleterious impacts were those associated with stream banks, cliffs and burrows. No mortality or injury was observed in any large animals. (auth)

6361 (SAND-75-5296) WIND DAMAGE TO WINDOWS AS ESTIMATED FROM EXPLOSION TESTS. Reed, J. W. (Sandia Labs., Albuquerque, N. Mex. (USA)). 1973. 4p. (CONF-750602-3). Dep. NTIS $4.00.

From second U. S. national conference on wind engineering research; Fort Collins, Colorado, USA (23 Jun 1975).

Window damage data from chemical and nuclear explosions were analyzed to provide information on the realistic behavior of installed glass. The results in terms of blast overpressure, were transformed to wind gust loadings of comparable time scales, and can be used to predict window breakage probability for various wind speeds. (LCL)

6362 (UCID-16692) TRANSIENT GAS FLOW THROUGH LAYERED POROUS MEDIA. Morrison, F. A. Jr. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 16 Jan 1975. Contract W-7405-eng-48. 44p. Dep. NTIS $5.25.

Low Reynolds number isothermal flow of an ideal gas through layered porous material was investigated analytically. Relations governing the transient flow in one dimension are obtained. An implicity, iterative, unconditionally stable finite difference scheme is developed for calculation of such flows. A computer code, SIROCCO, employing this technique has been written and implemented on the LLL computer system. A listing of the code is included. This code may be effectively applied to the evaluation of stemming plans for underground nuclear experiments. (auth)

6363 (UCID-16781) FEASIBILITY OF OBSERVATION OF CAVITY GROWTH BY EM SCATTERING. Wouters, L. F. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 1 Apr 1969. Contract W-7405-Eng-48. 18p. Dep. NTIS $4.00.

The feasibility of sensing the electromagnetic signal due to the interaction of a growing nuclear explosion cavity with an impressed, artificial, EM "illumination" field was studied. Such an expanding, conducting sphere was presumed to thereby "write" its history in the (underground) EM field distribution. The measurement challenge would be to extract this time-dependent change (or "scattering" signal) in the presence of the strong direct background from the field generator. The analysis appeared to be a two-part problem: "Visibility" – Is the scattered signal sufficiently large and discriminable? "Quality" – Can its features be measured sufficiently well to obtain meaningful information concerning cavity growth–such as total hydrodynamic energy? This brief paper and the extensive "Appendix" (UCID-16782) have the purposes of exhibiting the character and magnitude of the difficulties revealed by just the visibility phase, and of documenting its general conclusions, namely that the "optimum" embodiments involve either: requirements which are beyond the present state of EM technology, or requirements which invoke investments beyond the present range of programmatic interest and/or capacity. (auth)

6364 (UCID-16782) FEASIBILITY OF OBSERVATION OF CAVITY GROWTH BY EM SCATTERING (APPENDIX). Wouters, L. F. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 1 Apr 1968. Contract W-7405-Eng-48. 130p. Dep. NTIS $5.45.

This appendix to UCID-16781 includes the experimental conditions, configuration criteria and constraints, analysis descriptions, prototype cases, and tables and figures. (TFD)

6365 (UCRL-76280(Rev. 1)) PROJECT RIO BLANCO: PROJECT SCIENTIST'S SUMMARY REPORT OF PRODUCTION TEST DATA AND PRELIMINARY ANALYSIS OF TOP CHIMNEY/CAVITY. Toman, J. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Mar 1975. 34p. (CONF-750109-9). Dep. NTIS $4.75.

From 4th IAEA panel on peaceful nuclear explosives; Vienna, Austria (20 Jan 1975).

The reentry drilling established communication with the top Rio Blanco detonation region at a depth of 1704 meters, or about 76 meters above the top detonation center. A total of 2.8×10^6 m^3 of dry gas at standard conditions has now been produced during two separate test periods. Radioactive and chemical analysis of this gas and the modeling of the stimulated reservoir shows the following main results: (1) No permeable connection exists between the top and the middle detonation regions, since no significant amount of the tracer incorporated in the center explosive canister was detected in the produced gas. As a consequence, results for the top detonation region only are available at this time. (2) The initial cavity radius is deduced to be 20 m or well within expectations. (3) Integration of the ^{85}Kr produced indicates a yield of 34 +– 3 kt for the top explosive. (4) Of the approximately 1000 Ci of tritium produced in the top explosion region, about 5 percent is incorporated in the gas phase. (5) Pressure drawdown and buildup data are best reproduced by a two-layer reservoir model showing stimulated permeabilities about 10 and 30 times original formation permeabilities, and extending to a distance of about three cavity radii from the wellbore. (6) The capacity of the reservoir intercepted by the top explosive is deduced to be about 0.2 millidarcy-meters, as contrasted with preshot estimates ranging from 1.3 md-m to 2.3 md-m. (auth)

6366 COMPUTER DESIGN OF HIGH-EXPLOSIVE EXPERIMENTS TO SIMULATE SUBSURFACE NUCLEAR DETONATIONS. Burton, D. E.; Snell, C. M.; Bryan, J. B. (Univ. of California, Livermore). Nucl. Technol.; 26: No. 1, 65-87(May 1975).

Two-dimensional computer calculations were performed to model nuclear and high-explosive cratering detonations in saturated Bearpaw clay shale. Three calculations simulated 20-ton energy-yield nitromethane cratering experiments at burial depths of 6, 12.5, and 17 m. Results agreed with experimentally measured peak stresses, peak particle velocities, and crater dimensions. Calculations for a hypothetical nuclear source of the same energy at 12.5 m showed that only half as much kinetic energy was coupled into the mound; a correspondingly smaller crater was predicted. A 10-ton nitromethane source at 12.5 m was also calculated and was found to closely match the nuclear calculation. For these calculations, mound kinetic energy provided a valid criterion for achieving cratering similitude between high-explosive and nuclear events. In this case, similitude was obtained with a nitromethane source having about half the energy of the nuclear source. (auth)

6367 RADIOACTIVITY TRAPPED IN MELT PRODUCED BY A NUCLEAR EXPLOSION. Borg, I. Y. (Univ. of California, Livermore). Nucl. Technol.; 26: No. 1, 88-100(May 1975).

An inventory of ^{137}Cs, ^{106}Ru, ^{125}Sb, ^{144}Ce, ^{155}Eu, ^{90}Sr, ^{3}H, and assorted activation products in glass recovered in postshot cores from the Piledriver Event indicates that 60 percent of these fission products produced by the nuclear explosion are retained in the sampled glass. Chemical analyses of the major constituents of the glasses closely resemble those of the preshot rock except for the water content (which decreases) and conversion of original ferric iron to ferrous iron. Water in the glasses is close to the amount expected if quasi-equilibrium existed at the time of quenching; however, the amount of tritium in water contained by the glass is considerably below anticipated amounts. Calculations indicate that cavity pressure (56 bars) was about half overburden pressure (121 bars) at the time water ceased to evolve from the cooling melt. Not unexpectedly, rubble in the chimney at horizons immediately above the shot point is enriched in volatile fission products relative to ^{144}Ce and shows heterogeneous distribution of radioactivity. Some evidence of devitrification in the glasses was noted, but high-pressure polymorphs of original mineral constituents were not recognized. (auth)

Protective Structures and Equipment

Refer also to abstract 6046.

Safety Engineering

6368 (CONF-750515-1) REVIEW OF TRAINING METHODS EMPLOYED IN NUCLEAR FUEL FABRICATION PLANTS. Box, W. D.; Browder, F. N. (Oak Ridge National Lab., Tenn. (USA)). [nd]. 10p. Dep. NTIS $4.00.

From 2nd ANS symposium on training of nuclear facility personnel; Gatlinburg, Tennessee, USA (11 May 1975).

A search of the literature through the Nuclear Safety Information Center revealed that approximately 86 percent of the incidents that have occurred in fuel fabrication plants can be traced directly or indirectly to insufficient operator training. In view of these findings, a review was made of the training programs now employed by the nuclear fuel fabrication industry. Most companies give the new employee approximately 20 h of orientation courses, followed by 60 to 80 hr of on-the-job training. It was concluded that these training programs should be expanded in both scope and depth. A proposed program is outlined to offer guidance in improving the basic methods currently in use. (auth)

6369 (MND-3607-131-1) EVALUATION SUMMARY OF A SNAP POWER SYSTEM FOR DODGE-M SATELLITE. (Martin Marietta Corp., Baltimore, Md. (USA)). Feb 1967. 60p. Dep. NTIS $6.00.

Declassified 22 Jun 1972.

Graphic and tabulated data are presented on the design, operation, re-entry requirements, performance characteristics, safety, and production and testing schedule, for the SNAP-19 battery for the Dodge-M satellite. (LCL)

6370 (Y-DD-176) ANALYSIS OF LONG-TERM DATA ON URANIUM IN AIR AT Y-12. Sanders, M. (Oak Ridge Y-12 Plant, Tenn. (USA)). [nd]. 58p. (CONF-750445-3). Dep. NTIS $6.00.

From conference on occupational health experience with uranium; Arlington, Virginia, USA (28 Apr 1975).

The Y-12 Plant is primarily a manufacturing facility geared to the fabrication and processing of uranium into components to fulfill the nuclear weapon defense needs of the United States. This discussion covers the degree of positive engineering control required to reduce uranium airborne activity to a safe and acceptable level in the working environment. (auth)

Vacuum Engineering

Refer also to abstracts 7277 and 7306.

6371 (GEPP-136) COMPUTER CONTROL OF PARTIAL PRESSURE ANALYZER. Wedel, T. A. (General Electric Co., St. Petersburg, Fla. (USA). Neutron Devices Dept.). Apr 1975. Contract AT(29-2)-656. 10p. Dep. NTIS $4.00.

In order to more efficiently process data obtained from an Ultek partial pressure analyzer (10^{-5} to 10^{-11} torr), the analyzer was modified to interface with an Interdata Model 70 computer. A single connector provides the interface. Both range and mode settings are computer controlled, as are the filament and auto scan features of the instrument. (auth)

6372 NEW DEVELOPMENTS IN THE FIELD OF HIGH PERFORMANCE TURBOMOLECULAR PUMPS FOR THE PRODUCTION OF OIL-FREE HIGH AND ULTRAHIGH VACUUM. Henning, J. (Arthur Pfeiffer Vakunmtechnik GmbH, Wetzlar, Ger.). Jap. J. Appl. Phys.; No. Suppl. 2, 5-8(1974).

From 6th international vacuum congress; Kyoto, Japan (25 Mar 1974). See CONF-740353-.

A summary of the characteristics of turbo molecular pumps is followed by reflections on the development of new high performance turbo molecular pumps. An increase of the pumping speed can be obtained by increasing the rotor speed and/or by modifications of the rotor disc geometry. The interdependence of pumping speed and compression ratio is a decisive factor for the design of new turbo molecular pumps. Compression ratios for hydrogen below 300 result in a substantial reduction of the pumping speeds for light gases (H_2, He). The choice between horizontal and vertical rotor is determined by the maximum effective pumping speed obtainable and by the problems of maintenance and servicing. (auth)

6373 NEW SERIES OF TURBOMOLECULAR PUMPS. Baechler, W.; Frank, R.; Usselmann, E. (Leybold-Heraeus GmbH and Co. KG, Ger.). Jap. J. Appl. Phys.; No. Suppl. 2, 13-16(1974).

From 6th international vacuum congress; Kyoto, Japan (25 Mar 1974). See CONF-740353-.

The ever increasing field of application for high and ultra high vacuum free of hydrocarbons demands a series of turbomolecular pumps of high efficiency and adequately graduated in size according to the purpose. The new series meeting this demand consists of three sizes of series produced pumps of vertical design and with graduated rotor. This paper describes the design of the pumps and discusses the different aspects which had to be considered during the technical development. The three pumps, of about 400 mm in height each, differ by their diameter expressed in terms of their inlet ports, i.e., NW 100, 150, and 250. With a compression ratio of several 10^6 for air the resulting volume rates of flow (pumping speed) are 220, 450, and 1500 liter/s respectively. The rotation frequencies have been set at 36,000, 24,000, and 21,000 rpm respectively, being high enough to give the necessary circumferential velocities and, at the same time, low enough to ensure high structural reliability. The results represented demonstrate the typical behavior of volume rate of flow and compression ratio as a function of rotation frequency and nature of gas. (auth)

6374 LOW PRESSURE LIMITATION OF THE ORBITRON IONIZATION GAUGE. Blechschmidt, D. (CERN, Geneva). Jap. J. Appl. Phys.; No. Suppl. 2, 105-108(1974).

From 6th international vacuum congress; Kyoto, Japan (25 Mar 1974). See CONF-740353-.

It has often been supposed that the orbitron gauge is an instrument to measure pressures of less than 10^{-10} torr, since its theoretical low pressure limit is about 5×10^{-13} torr. In order to check this suggestion, some orbitron gauges of optimal design parameters have been studied at pressures below 10^{-10} torr. It is found that a low pressure limit for orbitron gauges of less than 2×10^{-11} torr is hardly achievable. This fact may be explained by space charges which are built up at very low pressures where the electron mean free path for electron-ion impact is in the order of some 10^5 cm. Due to this space charge, which appears as a potential barrier in the vicinity of the cathode, the number of electrons injected onto stable orbitals is drastically reduced. Hence, a major fraction of electrons fall onto the anode after only a few revolutions, thus giving rise to a higher x-ray limit than expected from theoretical predictions. (auth)

6375 IMPROVED METHOD FOR MEASUREMENTS OF VERY LOW PARTIAL PRESSURES. Miyake, H.; Michijima, M. (Kobe Univ. of Mercantile Marine, Japan). Jap. J. Appl. Phys.; No. Suppl. 2, 171-174(1974).

From 6th international vacuum congress; Kyoto, Japan (25 Mar 1974). See CONF-740353-.

An all metal 90° high sensitivity mass spectrometer has been improved for the analysis of partial pressures below 10^{-16} torr. Recurrent multi-channel scaling of ion currents synchronized with the scanning of the analyzer magnet current made it possible to measure ion currents below 10^{-20} A with high reliability for long operations, e.g., for two weeks runs. A 12-stage Allen-type secondary electron multiplier was used for ion detection. Pulse height distributions for various kinds of keV ions were studied in order to determine their true counting efficiencies. The methods for reducing background ions were also studied. (auth)

6376 ATTAINMENT OF OUTGASSING RATES BELOW 10^{-13} TORR LITERS/SEC CM^2 FOR ALUMINUM AND STAINLESS STEEL AFTER BAKEOUT AT MODERATE TEMPERATURES. Moraw, G.; Dobrozemsky, R. (Research Center, Seibersdorf, Austria). Jap. J. Appl. Phys.; No. Suppl. 2, 261-264(1974).

From 6th international vacuum congress; Kyoto, Japan (25 Mar 1974). See CONF-740353-.

Outgassing rates after bakeout were measured for stainless steel and aluminium by means of the throughput-method. Sample preparation before experiments: workshop machining, rinsing in acetone, 20 h vacuum bakeout at 150°C (to remove initial contaminations). Prior to each experiment the samples were filled with air (>96% relative humidity). After a 20 h vacuum bakeout at 100°C the outgassing rates are 4×10^{-14} torr liters/sec cm^2 for aluminium (mainly CO) and 1×10^{-12} torr liters/sec cm^2 for stainless steel (mainly H_2). After an air bakeout at 100°C (i.e., bakeout in air at atmospheric pressure for 2 h followed by a vacuum bakeout for 18 h) outgassing rates of 2.8×10^{-14} torr liters/sec cm^2 (Al) and 1×10^{-13} torr liters/sec cm^2 (s.s) are obtained. For stainless steel an air bakeout at 400°C followed by an 18 h vacuum bakeout gives outgassing rates in the low 10^{-14} torr liters/sec cm^2 range. These low outgassing rates of stainless steel are not affected by subsequent chemical etching or by mechanical polishing. Outgassing rates of below 2×10^{-15} torr liters/sec cm^2 can be achieved routinely from such samples after a 20 h vacuum bakeout at 100°C. (auth)

6377 UHV EVAPORATOR FOR THIN FILM GROWTH STUDY. Tominaga, G. (Tokyo Univ.); Hayashi, C.; Takeuchi, K.; Shinohara, G.; Kinosita, K. Jap. J. Appl. Phys.; No. Suppl. 2, 541-544 (1974).

From 6th international vacuum congress; Kyoto, Japan (25 Mar 1974). See CONF-740353-.

The design concept and the performance of an UHV evaporator are described. The evaporator is capable of maintaining the low 10^{-10} torr range throughout the evaporation period. A stainless steel bell jar, 0.5 m in dia and 0.6 m high, and a chamber for evaporation sources are connected with each other by two 7 mm dia openings. These two chambers are pumped separately by the respective sets of sorption, sputter-ion and Ti sublimation pumps. The bell jar contains a large liquid N_2-cooled shroud of 4.3 m^2 total area, within which 1.3 m^2 faces the vapour sources. Seven samples for electron microscopy which correspond to successive stages of film growth can be obtained in a single evaporation run. Gold has successfully been deposited at 1×10^{-10} torr at a rate of 0.01 Å/s. Pressure bursts during the rapid deposition of a second layer, carbon anchoring film, were up to the 10^{-9} torr range. (auth)

6378 ULTRAHIGH VACUUM TECHNIQUES IN THE INSTITUTE OF SCIENTIFIC INSTRUMENTS, CZECHOSLOVAKIA ACADEMY OF SCIENCES. Zobac, L. (CSAV, Brno). Cesk. Cas. Fys.; 25: No. 1, 38-47(1975). (In Czech).

The ultrahigh vacuum techniques and elements which have been developed and are in common use for production and measurement of very low pressures in electron optical instruments designed in the Institute of Scientific Instruments, Czech. Acad. Sci. are reviewed. A brief description of their construction and their main technical data are given. (auth)

ENVIRONMENTAL AND EARTH SCIENCES

Minerals and Ores

Refer also to abstracts 6431, 6455, 6595, 6792, and 8391.

6379 (AEC-RID-1) SUMMARY AND TABULATION OF SULFUR-ISOTOPE WORK. Austin, S. R. (USAEC Grand Junction Office, Colo.). Jan 1968. 23p. GJO.

The ratios of stable, nonradiogenic isotopes of several elements, especially some of the lighter common elements, such as carbon, oxygen and sulfur, have proven useful in solving geologic problems. Of these, sulfur isotopes have received the most attention in relation to uranium deposits. The sulfur-isotope ratios in a number of uranium host rocks from various locations are reported. It is postulated that the formation of uranium deposits with accompanying sulfide mineralization is not a random process but is the result of fractionation of sulfur by sulfur-reducing bacteria acting within the roll structure, with fractionation culminating at or near the solution front. It is also postulated that bacteriogenic H_2S may act as a reducing agent to precipitate uranium as well as reacting with iron to form iron sulfide minerals. (CH)

6380 (AED-CONF-74-600-005) PROSPECTION FOR AND EXPLORATION OF URANIUM. Venzlaff, H. (Bundesanstalt fuer Bodenforschung, Hannover-Buchholz (F. R. Germany)). 1974. 17p. (In German). INIS.

From symposium on natural uranium supply; Mainz, F. R. Germany (18 Nov 1974).

The estimates so far published about the uranium reserves contained in the crust of the earth are still very inaccurate. Uranium deposits so far hardly explored because of their relatively low uranium contents are: (a) pegmatites and lode-type deposits, and (b) sedimentary deposits, which break down into conglomerate deposits and sandstone deposits. Reasonable methods of planning for prospection activities are outlined. In addition to geological methods especially geochemical and geophysical methods are considered. The advantages and disadvantages as well as the practical steps of implementation are discussed. Various drilling methods are used for exploration purposes. The expenditure in terms of time and funds involved in prospection and exploration activities is mentioned. The importance and practical value of good international agreements and schemes for cooperation is emphasized. (GE)

6381 (AED-CONF-74-600-007) URANIUM MINING. Hampel, H. R. (Urangesellschaft m. b. H. und Co. K. G., Frankfurt am Main (F. R. Germany)). 1974. 35p. (In German). INIS.

From symposium on natural uranium supply; Mainz, F. R. Germany (18 Nov 1974).

With figs. and tabs.

A general presentation of the preconditions for the construction and operation of a uranium mine, the treatment of a deposit, the most important mining processes as well as the non-classical uranium mining methods is given. Furthermore, a description of the uranium mining in the most important countries of the western world is given. (GE)

6382 (AED-CONF-74-600-012) CANADA'S URANIUM POLICY. Runalls, O. J. C. (Department of Energy, Mines and Resources, Ottawa, Ontario (Canada)). 1974. 9p. INIS.

From symposium on natural uranium supply; Mainz, F. R. Germany (18 Nov 1974).

Based on the consideration of the uranium situation in Canada (occurrence, supplies, production and availability) and due to the long-term securing of its own uranium supply, the guidelines of the new (January 1974) Canadian uranium policy are explained. (GE)

6383 (AED-CONF-74-600-013) URANIUM MINING AND MARKETING IN SOUTH AFRICA. Worrall, R. E. (Nuclear Fuels Corp. of South Africa Pty. Ltd., Johannesburg). 1974. 16p. INIS.

From symposium on natural uranium supply; Mainz, F. R. Germany (18 Nov 1974).

Available from ZAED.

Uranium is a by-product in the recovery of gold in South Africa. The development of this recovery is outlined up to the present common extraction methods of uranium. Furthermore the organization of the cooperation of various mines is described. The hitherto adaptation of production to the market will also be able to continue in the future if higher uranium prices allow the uranium recovery from low-content ores. (GE)

6384 (CONF-750317-, pp 17-36) U. S. URANIUM SITUATION. Patterson, J. A. (Div. of Production and Materials Management, Washington, DC). 1975.

From atomic industrial fuel cycle conference; Atlanta, Georgia, USA (18 Mar 1975).

In AIF fuel cycle conference '75.

The uranium market remains strong as utilities seek additional uranium supply contracts, particularly for delivery in the 1980's. Difficulties in contracting for uranium and greater awareness of potential future uranium supply difficulties have increased utility concern over their fuel supply position and their procurement strategies. Prices have risen dramatically in the last year and are now two to three times what they were in early 1974. On the uranium supply side, exploration in the U. S. increased in 1974 after several years of diminished effort, but net additions to ore reserves continue to be minimal and largely in established districts; costs have been increasing rapidly. Knowledge of domestic resources is improving, and the ERDA program, reexamining the favorability of the country for the occurrence of uranium deposits, is moving at a more rapid rate with the increased availability of funds. (auth)

6385 (GJO-108(74)(Pt. 1 and 2)) URANIUM INDUSTRY SEMINAR, OCTOBER 22-23, 1974. Part I and Part II. (USAEC Grand Junction Office, Colo.). Nov 1974. vp. GJO $7.60.

Separate abstracts were prepared for the 13 papers presented. (CH)

For abstracts of individual papers see: 6386-6398.

6386 (GJO-108(74)(Pt. 1), pp 7-37) NUCLEAR POWER GROWTH, ENRICHMENT, AND URANIUM REQUIREMENTS, 1974 TO YEAR 2000. Hanrahan, E. J. Nov 1974.

In Uranium industry seminar, October 22-23, 1974. Part I and Part II.

The accuracy of predictions of uranium requirements based on the Office of Planning and Analysis February 1974 forecast of energy, electric power and nuclear power through the year 2000 is discussed. Topics discussed include the uranium requirements for the U. S. and foreign industry based on enrichment contracts already signed with the AEC; methodology and models used by the forecast and the results of sensitivity analyses on some of the parameters involved, such as plutonium recycle and breeder introduction; and the effects of the recently announced nuclear power plant slippages, deferrals, and cancellations. It was concluded that it is impossible to predict future demands for uranium with accuracy at this time. (CH)

6387 (GJO-108(74)(Pt. 1), pp 38-52) U. S. URANIUM SALES AND COMMITMENTS. Patterson, J. A. Nov 1974.

In uranium industry seminar, October 22-23, 1974. Part I and Part II.

Data are presented on uranium sales to date in the USA and commitments for future deliveries. Data are also included on uranium prices in 1973 and 1974. (CH)

6388 (GJO-108(74)(Pt. 1), pp 53-72) NATIONAL URANIUM RESOURCE PROGRAM. Bowyer, B. Nov 1974.

In Uranium industry seminar, October 22-23, 1974. Part I and Part II.

In the spring of 1973, the Atomic Energy Commission (now ERDA) initiated a comprehensive program to evaluate domestic uranium resources and to identify areas favorable for uranium exploration. This program, the National Uranium Resource Evaluation (NURE), will provide information on uranium resources, both discovered and undiscovered, for use in assessing the domestic uranium supply position; in other words through the program it will be determined how much uranium has been found, or can reasonably be expected to be found, which can be exploited to meet nuclear fuel requirements within probable economic, production, and lead-time constraints. The major objectives and milestones of the NURE are reviewed. (auth)

6389 (GJO-108(74)(Pt. 1), pp 73-82) CURRENT URANIUM ORE RESERVES. Appelin, C. W. Nov 1974.

In uranium industry seminar, October 22-23, 1974. Part I and Part II.

The objective of the ERDA ore reserve program is to maintain an accurate and current inventory of discovered domestic uranium resources which have been confirmed, within various degrees of reliability, by samples and measurements obtained from drilling, mining, or surface outcrops. These discovered resources are evaluated independently, on a property by property basis, by the ERDA using raw data provided by the uranium companies. In the course of this work the ERDA also collects data on ore production, costs, mining and milling methods, and exploration and development drilling. The principal purpose of developing and compiling this information is for use by the ERDA, the uranium companies, and other federal and state agencies for advanced planning of

various uranium and energy resource programs. The status of domestic ore reserves is previewed annually at the uranium industry seminar sponsored by the Grand Junction Office, and it is published in various publications, particularly GJO-100, Statistical Data of the Uranium Industry. (auth)

6390 (GJO-108(74)(Pt. 1), pp 83-90) POTENTIAL RESOURCES OF URANIUM. Chenoweth, W. L. Nov 1974.
In uranium industry seminar, October 22-23, 1974. Part I and Part II.

Uranium potential may be defined as a geologic judgment of the undiscovered tons of U_3O_8 present in minable amounts in areas that are relatively unexplored in detail, but about which enough is known of the uranium geology to permit prediction of the nature and extent of favorable environments or host rocks. The geographic locations of potential deposits may be definable only within broad limits. Providing the qualitative nature of potential is recognized and taken into account, potential plus reserves provide a more useful base for long-range predictions of domestic supply than do reserves alone. The estimated potential resources of uranium are surmised to occur in unexplored extensions of known deposits, postulated deposits within known uranium areas, and postulated deposits in other areas geologically favorable for uranium. The deposits are expected to be discoverable and exploitable within selected cost ranges. (auth)

6391 (GJO-108(74)(Pt. 1), pp 91-113) SUBJECTIVE PROBABILITY STUDY OF URANIUM RESOURCES IN THE STATE OF NEW MEXICO. Ellis, J. R. Nov 1974.
In uranium industry seminar, October 22-23, 1974. Part I and Part II.

As part of the R & D activities of the Grand Junction Office in support of the current uranium resource program, geostatistical methods of resource assessment are being evaluated. One of these, a statistical method of assessing undiscovered uranium resources known as Subjective Probability was undertaken to evaluate its usefulness compared to conventional methods of resource estimation in New Mexico. This method may be used in other places where a sufficient number of experts possess the required geological knowledge for realistic estimation of resources. Thirty-six geologists and explorationists, including 26 from industry, 7 from government, and 3 from universities, participated in this study. Each was assured anonymity by use of number identification, known only to the respondent and the AEC project leader. Results of this study are reviewed. Supporting information in illustrations and tables are referenced in the text and are attached as an appendix. (auth)

6392 (GJO-108(74)(Pt. 1), pp 114-131) EXPLORATION PLANS AND TRENDS. Meehan, R. J. Nov 1974.
In uranium industry seminar, October 22-23, 1974. Part I and Part II.

Data on uranium exploration plans and trends in the USA are presented in charts and tables. (CH)

6393 (GJO-108(74)(Pt. 1), pp 132-135) U. S. URANIUM SUPPLY: PRODUCTION STATISTICS. Facer, J. F. Nov 1974.
In uranium industry seminar, October 22-23, 1974. Part I and Part II.

Statistics are presented for various aspects of uranium production in the USA from 1966 through 1973. Production for 1974 and 1975 is estimated. (CH)

6394 (GJO-108(74)(Pt. 1), pp 136-178) DOMESTIC PRODUCTION CAPABILITY 1974-1988. Barnes, C. H. Nov 1974.
In uranium industry seminar, October 22-23, 1974. Part I and Part II.

The Atomic Energy Commission (now ERDA) publishes yearly estimates of domestic uranium ore reserves, potential resources, and production capability as part of an overall program of nuclear fuel supply assessment. The main objectives of the program are: to determine the magnitude of current domestic uranium ore reserves at various production costs; to estimate, using current knowledge, the additional undiscovered uranium resources which might occur in identified favorable areas and other areas; and to analyze and forecast the capability of the industry to produce concentrates from these resources. (auth)

6395 (GJO-108(74)(Pt. 2), pp 5-38) ESTIMATE OF THE ECONOMICS OF URANIUM CONCENTRATE PRODUCTION FROM LOW-GRADE SOURCES. Klemenic, J. Nov 1974.
In uranium industry seminar, October 22-23, 1974. Part I and Part II.

Estimates are presented of the economics of uranium concentrate production in the USA from low-grade uranium ores obtained by open-pit and underground mining methods. (CH)

6396 (GJO-108(74)(Pt. 2), pp 39-62) GEOLOGY AND RESOURCES OF FOREIGN URANIUM DEPOSITS. Adler, H. H. Nov 1974.
In uranium industry seminar, October 22-23, 1974. Part I and Part II.

Data are summarized on uranium deposits known to exist in Australia, Canada, France, Africa, Portugal, Spain, Argentina, and Brazil. (CH)

6397 (GJO-108(74)(Pt. 2), pp 63-71) FOREIGN PRODUCTION CAPABILITY AND SUPPLY. Patterson, J. A. Nov 1974.
In uranium industry seminar, October 22-23, 1974. Part I and Part II.

Data are presented from estimates of the uranium production capability of Australia, Canada, France, and Africa. (CH)

6398 (GJO-108(74)(Pt. 2), pp 72-87) VERSATILITY OF FEED IN SUPPLY OF ENRICHED URANIUM. Baranowski, F. P. Nov 1974.
In uranium industry seminar, October 22-23, 1974. Part I and Part II.

The adequacy of uranium resources to meet the projected long-range nuclear power demands is discussed. The necessity for long-term planning to assure adequate facilities and resources for the production of nuclear feed materials and for separative work is stressed. The status of the USA uranium enrichment program is reviewed on the basis of contracts for enrichment services awarded by the AEC. Possible situations requiring increased natural uranium demands are considered. (CH)

6399 (NP-20303) METHODS OF OPERATION EL NOPAL MINE. de la Vega C., J. J. (Universidad Autonoma de Chihuahua (Mexico). Escuela de Ingenieria). 1973. 119p. (In Spanish). Dep. NTIS (US Sales Only) $9.00.
Thesis.

After a brief discussion of the characteristics of the area of the El Nopal mine, the geology of the area is described in detail with a discussion of the stratigraphy, historical geology, and structural geology. The geology of the ore itself is considered. Possible methods for the operation of the mine are examined with special reference to the needs for radiological safety. The processing and beneficiation of the ore is discussed. (JSR)

6400 SPECTACLE ARRAY OF ^{210}Po HALO RADIOCENTRES IN BIOTITE: A NUCLEAR GEOPHYSICAL ENIGMA. Gentry, R. V.; Hulett, L. D.; Cristy, S. S.; McLaughlin, J. F.; McHugh, J. A.; Bayard, M. (Oak Ridge National Lab., TN). Nature (London); 252: No. 5484, 564-566(13 Dec 1974).

It is stated that although Po radiohaloes occur widely in nature, their existence has so far defied satisfactory explanation based on accepted nucleocosmogeochemical theories. Questions that arise are-do these haloes imply that unknown processes were operative during the Earth's formation period, and is it possible that the Po haloes represent extinct natural radioactivity and are therefore of cosmological significance. A detailed comparison is here presented between an unusual array of Po halo radiocenters and U-Th halo centers, as bearing on the foregoing questions. Types of radiohaloes normally met with are briefly described, but a striking exception has been found in a Precambrian biotite from Silver Crater Mine, Faraday Township, Ontario; this is referred to as "spectacle" type, and shows two almost circular rings of inclusions joined by a linear array of inclusions. The properties of this halo are described. The radius of the coloration band indicated an origin from ^{210}Po α-decay. Mass spectrometric and x-ray fluorescence methods were employed to check whether this was indeed a Po halo array. Comparative tests with U-Th haloes are described. An outstanding feature of the mass analysis was a prominent 206 signal which, if attributed to the presence of ^{206}Pb, indicates that the ^{206}Pb was radiogenically derived not from U or Th but directly from ^{210}Po α-decay. A conclusion reached is that a "new" type of Pb derived from Po α-decay exists in nature. (auth)

6401 NEW METHOD FOR THE EVALUATION OF POTENTIAL URANIUM RESOURCES IN THE SAN JUAN BASIN, NEW MEXICO, U. S. A. Com. Naz. Energ. Nucl., Not.; 21: No. 1, 66-67(Jan 1975). (In Italian).

A description of the new method for the evaluation of potential uranium resources in the San Juan Basin, which is the foremost uranium production area in the United States, is given. This new method has become necessary since the evaluation so far made by the Commission was believed to be too conservative. (auth)

6402 IMMEDIATE AND FUTURE URANIUM SUPPLIES IN THE WORLD AND IN ITALY. Bettinali, C.; Pantanetti, F. (CNEN, Milan). Com. Naz. Energ. Nucl., Not.; 21: No. 1, 51-65(Jan 1975). (In Italian).

From 13th nuclear energy conference; Milan, Italy (12 Dec 1974).

The picture of uranium supplies in the world, in its present state and future prospects, with particular reference to the Italian situation is reviewed. (auth)

6403 POTENTIAL FOR SANDSTONE-TYPE URANIUM DEPOSITS IN JURASSIC ROCKS, KHORAT PLATEAU, THAILAND. Shawe, D. R.; Hite, R. J.; Inthuputi, B. (Geological Survey, Washington, DC). Econ. Geol.; 70: No. 3, 538-541(May 1975).

Geological similarity between the Khorat Plateau of northeastern Thailand and the Colorado Plateau of the western United States, together with recent discovery of a uranium-copper deposit in sandstone in the Khorat Plateau, suggests that the Khorat Plateau may have substantial potential for uranium resources. The most likely host rocks for uranium deposits appear to be carbonaceous fluvial sandstones and conglomeratic sandstones of the Jurassic Phra Wihan, Sao Khua, and Phu Phan Formations making up the middle part of the Khorat Group of Triassic, Jurassic, and Cretaceous age. An occurrence of uranium and copper minerals is known in probably Lower Jurassic yellowish-gray and gray carbonaceous sandstone and conglomeratic sandstone (Phra Wihan Formation) in the Phu Wieng district near the west edge of the Khorat Plateau. (auth)

Radioactive Effluents

6404 (AD/A-002464) SENSITIVITY OF FALLOUT PREDICTIONS TO INITIAL CONDITIONS AND MODE ASSUMPTIONS. Final Report, 15 November 1973–15 June 1974. McGahan, J. T.; Kownacki, E. J. (Science Applications, Inc., McLean, Va. (USA)). Dec 1974. Contract DNA001-74-G-0096. 205p. (DNA-3439F). NTIS $7.25.

Results are presented of an investigation into the effect of uncertainties in both initial conditions and model assumptions on fallout characteristics. The DELFIC code was used to provide baseline predictions. Among the specific areas considered are cloud rise, spatial distribution of dust, fractionation, dust size distribution, neutron activation, height-of-burst effects, and burst parameter uncertainties. (GRA)

6405 (JUL-1165) LONG-TERM ASPECTS OF THE ENVIRONMENTAL BURDEN FROM ENERGY PRODUCTION: CO_2 AND ^3H. Niehaus, F. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany)). Feb 1975. 167p. (In German). Dep. NTIS (U. S. Sales Only) $11.50.

Thesis. Submitted to Technische Hochschule, Aachen, West Germany.

Carbon dioxide and tritium emissions from fossil or nuclear power plants were studied. The analysis of possible effects of alternative strategies to meet future energy demand on the temperature of the atmosphere depends on the mathematical model of the global carbon dioxide cycle which uses nonlinear differential equations. As there have to be substitutions of fossile power plants by nuclear facilities another model was constructed to simulate the water cycle of the northern and southern hemispheres by which it is possible to compute the effects of tritium emissions in the future. (149 references) (auth)

6406 (LF-49, pp 80-84) MATHEMATICAL MODEL FOR PREDICTING ENVIRONMENTAL AND HUMAN HEALTH EFFECTS OF DEVELOPING NUCLEAR REACTOR PROGRAMS. Cuddihy, R. G.; Chapman, L. D.; Wayland, J. R.; Dugan, V. L.; McClellan, R. O. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973-1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

Anticipated development of nuclear reactor systems for production of electrical power with associated normal releases of transuranic elements to the environment makes it necessary to develop comprehensive analyses of their possible impact upon human health. Such analyses must address possible sources for radioactivity releases, environmental transport, accumulation in biological species and related deposition and health risks in man. Mathematical models of these systems adapted to rapid computer solution are being developed to aid in projecting the total and time-dependent human risk factors related to nuclear power development. These studies will also attempt to identify the most sensitive aspects and assumptions of the total health risk assessments and will generally be applicable to effluents from non-nuclear as well as nuclear sources. In both cases, the results can be used to define guidelines for general siting considerations. (auth)

6407 ERDA RADIOLOGICAL ASSISTANCE PROGRAM. Smalley, W. L. (Energy Research and Development Administration, Oak Ridge, TN). Nucl. Saf.; 16: No. 3, 345-353(1975).

The Energy Research and Development Administration (ERDA) Radiological Assistance Program provides advice and assistance at the scene of a radiological incident when ERDA believes that such action is necessary or on request from other agencies or individuals. The types of assistance available and means of obtaining that assistance are discussed and statistics summarizing the experience with the program are presented along with guidelines for handling radiological emergencies. (auth)

6408 ENERGY SUPPLY AND ENVIRONMENTAL CONTAMINATION IN MEXICO. Guiza, J.; Hernandez de la Torre, A.; Linares, E.; Tolivia, E.; Zepeda, C. Energ. Nucl. (Madrid); 18: No. 90, 253–257(1974). (In Spanish).

The present method used to supply energy produce to a greater or lesser degree contamination of the environment. In the present work a study is made of the different systems for the generation of electrical energy and they are compared with respect to their effect on the environmental contamination. The systems considered are thermoelectric, nuclear electric, geothermal, and hydroelectric. An analysis is made of the present status in Mexico of each of these and their contribution to atmospheric pollution. Means to reduce the environmental contamination are discussed. (JSR)

6409 (ZJE-157) ATMOSPHERIC DISPERSION OF ORDINARY AND RADIOACTIVE IMPURITIES. Veverka, O.; Vlachovsky, K. (Skoda, Pizen (Czechoslovakia)). 1975. 79p. Dep. NTIS (US Sales Only) $7.00.

The atmospheric transport and turbulent diffusion of radioactive particles are discussed and a detailed review is presented of analytically solved problems based on postulated diffusion equation. Statistical methods developed by Roberts, Sutton, and Pasquill, together with the deposition processes and empirically determined data given by various authors and a short comparison with Soviet methods are included. Computer calculations of plume depletion and deposition processes using the program METEO are also included. (CH)

Radioactivity Monitoring and Transport

Refer also to abstracts 5906, 5910, 6360, 6458, 6459, 6523, 6698, and 6878.

6410 (COO-2308-003) AVIAN RADIOECOLOGY ON A NUCLEAR POWER STATION SITE. Technical Progress Report, 1 July 1974–30 June 1975. Levy, C. K. (Manomet Bird Observatory, Mass. (USA)). 1975. Contract AT(11-1)-2308. 55p. Dep. NTIS $5.75.

The continuation of a program demonstrating that free-ranging wild birds can be used to assess environmental radionuclide levels is described. Wild passerine birds are trapped at a nuclear power station site and at two control sites, uniquely marked, non-destructively counted for levels of gamma-emitting radionuclides, and released. Subsequent recapture rates are as high as 80 percent for certain species. Nuclides detected included ^{40}K, ^{95}Zr-^{95}Nb, ^{137}Cs, and apparent ^{131}I, the latter at levels just above detection limits (0.07 pCi/g). Significant variations in mean ^{137}Cs body burdens in Blue Jays and Bobwhite have been observed between sites less than 6 km apart. A significant temporal decrease in ^{137}Cs body burdens has been observed in various species of birds only at the reactor site. Vegetation and meteorological studies have been initiated to help explain these body-burden differences. The effective half-life of ^{137}Cs in the Blue Jay is 6.7 ± 1.5 days. The highest observed level of ^{95}Zr-^{95}Nb (1.08 ± 0.07 pCi/g) was in a Grey Catbird. The effective half-life of the ^{95}Zr-^{95}Nb was 69.9 ± 15 days, corresponding to the physical half-life of this isotope pair (65.5d), and the activity abruptly disappeared after the twelfth day of captivity suggesting that it was present in particulate form either on the feathers or skin, or in the bird's pulmonary system. Interlaboratory comparisons of radionuclide measurements are reported. The number of birds banded during the current reporting period is 2720, while 2047 specimens were radioassayed, an increase of 9 percent and 313 percent, respectively. An exercise to test the practicality of obtaining avian samples from remote sites (i.e., greater than 50 miles away) for radionuclide measurement was performed satisfactorily. (auth)

6411 (DPSPU-75-30-1) ENVIRONMENTAL MONITORING IN THE VICINITY OF THE SAVANNAH RIVER PLANT. Annual Report, 1974. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Plant). 1974. 38p. Dep. NTIS $5.00.

The results obtained from the environmental monitoring program at the Savannah River Plant during 1974 are presented. An inventory of radioactive materials released to the environment, and data on radioactivity in samples of surface air, surface waters, soil, plants, and food are included. Data are also included on pesticides in Savannah River sediment. (CH)

6412 (ERDA-35) FEASIBILITY OF STANDARDIZATION IN GLOBAL MONITORING OF POLLUTANT DISTRIBUTIONS. Report of the Working Group, July 3–5, 1974, Edinburgh, Scot-

land. (Energy Research and Development Administration, Washington, D. C. (USA)). 1974. 26p. Dep. NTIS $4.00.

The monitoring of pollution that is distributed globally cannot be carried out readily by a single laboratory. On the other hand the evaluation and application of such data require that all measurements be comparable and of equal validity. One approach to attaining such comparability is to standardize methods of sampling and analysis. This possibility is discussed. Pollutants discussed include particulates, sulfates, CO, CO_2, ammonia, trace metals, ozone, hydrocarbons, nitrates, pesticides, freon, tritium, ^{14}C, ^{85}Kr, Pu, and fission products. (CH)

6413 (IS-3613) ENVIRONMENTAL MONITORING AT AMES LABORATORY: CALENDAR YEAR, 1974. Voss, M. D. (Ames Lab., Iowa (USA)). May 1975. Contract W-7405-Eng-82. 83p. Dep. NTIS $7.25.

The effluent and environmental monitoring program at Ames Laboratory of the United States Energy Research and Development Administration is summarized. This report for 1974 is the first in the series showing the transition to the use of specific isotopic analyses for all effluent sampling, as well as for some specific environmental sampling. An inventory of the radioactive materials and certain chemicals released to the environment is included. A summary of the radioactivity found in the environment is presented. An estimate of the radiation dose to the public resulting from the operations of the Ames Laboratory is included. (auth)

6414 (KURRI-TR-116) REPORT OF RADIATION MONITORING IN LABORATORIES, 9. Katsurayama, K.; Tsujimoto, T.; Saito, M.; Tsuruta, T.; Fukui, M. (Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst.). 1973. 26p. (In Japanese). INIS.

Records of radiation management during a full year of 1972 at the Reactor Experimental Laboratory of Kyoto University are presented. The laboratory has a 5,000 kW swimming pool type research reactor, hot-laboratory, tracer laboratory, 11,600 Ci Co^{60} irradiation facility, 48 MeV linear accelerator for neutron generation, and radioactive waste disposal facility. Various measurements of radioactivity for safety control are carried out, and their results are being kept and summarized monthly and annually for all of the facilities within the laboratory. This report presents the items, methods and locations of measurements. The results are further analyzed, and many valuable suggestions for better management are described. The annual release rate of ^{41}Ar from a stack and the dose rate at the periphery of the laboratory site for 8 years were calculated on the basis of the meteorological condition of the site. According to the calculation, the release rate and the dose rate during 1972 was 582 Ci/year and 2.95 mrem/year, respectively. (JA)

6415 (LA-5977-PR) ENVIRONMENTAL SURVEILLANCE AT LOS ALAMOS DURING 1974. Apt, K. E.; Lee, V. J. (Comps.). (Los Alamos Scientific Lab., N. Mex. (USA)). May 1975. Contract W-7405-eng-36. 52p. Dep. NTIS $5.45.

The CY 1974 environmental monitoring program of the Los Alamos Scientific Laboratory (LASL) is documented. Data are presented for concentrations of radioactivity measured in air, ground, and surface waters, sediments, and soils, and those data are compared with relevant AEC guides and/or data from other reporting periods. Levels of external penetrating radiation measured in the LASL environs are given. The average whole-body radiation dose to residents of Los Alamos County resulting from LASL operations is calculated. Chemical and biological qualities of surface and ground waters of the LASL environs have been determined and are compared to applicable standards. Results of related environmental studies are provided. (auth)

6416 (MLM-2232) ANNUAL ENVIRONMENTAL MONITORING REPORT: CALENDAR YEAR 1974. Carfagno, D. G.; Robinson, B. (Mound Lab., Miamisburg, Ohio (USA)). 30 Apr 1975. Contract AT-33-1-GEN-53. 40p. Dep. NTIS $4.00.

The environment surrounding Mound Laboratory was monitored and results are reported for calendar year 1974. Samples analyzed included air, water, foodstuffs, soil, and silt. For radioactive species, the average concentrations of polonium-210, plutonium-238, and tritium detected were well within the stringent standards adopted by the Energy Research and Development Administration and the Environmental Protection Agency. Data concerning nonradioactive species in air and water are also presented. (auth)

6417 (NP-20415) RADIOACTIVE FALLOUT REPORT FOR 1974. Kahraman, N.; Baycan, G.; Saygili, N. (Atomenerjisi Komisyonu, Ankara (Turkey)). Mar 1975. 21p. (In English and Turkish). Dep. NTIS (US Sales Only) $4.25.

The results of radioactive fallout analysis carried out at Ankara, Turkey for the year 1974 are presented. Air, rainwater, and milk samples were collected monthly from Ankara area. In air samples gross beta, Sr-90, Sr-89, and Cs-137, in rainwater samples Sr-90, Sr-89, Cs-137, and in milk samples Sr-90 and Cs-137 determinations were made. (auth)

6418 (SAND-75-0257) ENVIRONMENTAL MONITORING REPORT, SANDIA LABORATORIES 1974. Holley, W. L. (Sandia Labs., Albuquerque, N. Mex. (USA)). May 1975. Contract AT(29-1)-789. 17p. Dep. NTIS $4.00.

Water and vegetation are monitored to determine the effect that Sandia Laboratories has on the surrounding environment. Nonradioactive pollutants released to the environment are reported. Ejected radioactive effluents are analyzed for their influence on the Albuquerque area. It is concluded that the operation of Sandia Laboratories has not been detrimental to the environment during CY 1974. (auth)

6419 (SCPRI(RM)-10-1974(App.)) APPENDIX TO THE MONTHLY PROGRESS REPORT. Details of the Results of Measurements. (Service Central de Protection contre les Rayonnements Ionisants, 78 - Le Vesinet (France)). Oct 1974. 21p. (In French). INIS.

Measurement tables concerning the surveillance of the environment are presented. (see also the SCPRI-RM-10-1974 report). (FR)

6420 (SREL-3) SAVANNAH RIVER ECOLOGY LABORATORY ANNUAL REPORT. (Georgia Univ., Athens (USA). Inst. of Ecology). May 1975. Contract AT(38-1)-819. 92p. Dep. NTIS $7.75.

Separate abstracts were prepared for three sections of the report. A fourth section is included on SREL-ERDA laboratory cooperative programs. (HLW)

For abstracts of individual sections see: 6421, 6468, and 8426.

6421 (SREL-3, pp 69-72) TRANSURANIC ELEMENTS PROGRAM. Adriano, D. C.; McLeod, K. W.; Paine, D.; Pinder, J. E. III; Smith, M. H. May 1975.

In Savannah River Ecology Laboratory annual report. (Georgia Univ., Athens (USA). Inst. of Ecology).

Progress is reported on the following research projects: transuranic cycling; plutonium inventory for abandoned oldfield ecosystem; and pathways of plutonium contamination to wheat. (HLW)

6422 (TID-26782) ^{141}Ce, ^{144}Ce ACTIVITIES MEASURED IN RAIN SAMPLES AT FAYETTEVILLE, ARKANSAS FROM JANUARY 1973-JUNE 1974. Holloway, R. W. (Arkansas Univ., Fayetteville (USA). Dept. of Chemistry). 1974. 5p. Dep. NTIS $4.00.

Data are presented on radioactive cerium fallout measured at Fayetteville, Arkansas in rain samples during the period from January 1973 to June 1974. It is pointed out that the order of magnitude increase in ^{144}Ce fallout that occurred in the spring of 1974 resulted from the 15th Chinese nuclear test explosion of June 27, 1973. This device was reported to be an air burst of about 3 Mt total fission yield. A sharp increase in ^{141}Ce was also seen on July 10, 1974 signaling the arrival of fresh fission products from the 15th Chinese test. The data given an irregular pattern of variation with time that is not related to the cycling of fission products around the world. Several of the data points (for example, Oct. 11 and Nov. 25 to 27) can be easily shown to exceed the theoretical production ratio for fission products in the 15th Chinese test explosion. (auth)

6423 (TID-26812) RADIOACTIVE STRONTIUM AND BARIUM FALLOUT AT FAYETTEVILLE, ARKANSAS FROM OCTOBER 1958-JUNE 1974. Sumerlin, N. G. (Arkansas Univ., Fayetteville (USA). Dept. of Chemistry). 1975. 43p. Dep. NTIS $5.45.

Data are presented on the ^{89}Sr, ^{90}Sr, ^{140}Ba concentrations and the $^{89}Sr/^{90}Sr$ ratio measured in rain and snow samples at Fayetteville, Arkansas for the period October 1958 to June 1974. (auth)

6424 KINETICS EQUATION FOR LINEAR FIRST-ORDER NUCLEAR PHENOMENA. Skrable, K. (Lowell Technological Inst., MA); French, C.; Chabot, G.; Major, A.; Ward, K. Nucl. Saf.; 16: No. 3, 337-344(1975).

A general equation for the kinetics of serially related quantities linked by linear first-order production and destruction phenomena is described. The equation is applicable to systems of concern in nuclear and radiological sciences and health physics. Suggested applications include (1) the serial transformation of radionuclides; (2) the collection and analysis of serially related airborne radioactive particulates; (3) the inventory of quantities in the core of a nuclear reactor, such as fission products, poisons, fissile elements, and transuranium elements; (4) internal dosimetry, such as the burden of radionuclides in the various segments of the gastrointestinal tract and resulting doses for single or continuous

intakes of parent as well as daughter radionuclides; (5) the quantity of airborne radioactive aerosols generated in a ventilated space through the decay of parent inert radioactive gases, such as radon, thoron, xenon, and krypton; and (6) the calculation of routine and accidental releases from nuclear plants. (auth)

6425 ENVIRONMENTAL RADIATION EFFECTS OF NUCLEAR FACILITIES IN NEW YORK STATE. Terpilak, M. S.; Jorgensen, B. L. (Environmental Protection Agency's Region II, New York). Nucl. Safety; 16: No. 2, 204-222(1975).

The annual quantities and types of radioactive materials released from three operating nuclear electric generating facilities and a nuclear fuels-reprocessing facility are presented and discussed. The period of interest spans the years 1969 to 1972 with some additional data for those facilities operating before 1969. Release quantities have been well controlled, considering the nature and vintage of the operations. Presented are the results of environmental surveillance relying most heavily on the activities of the New York State Department of Environmental Conservation. Observations at Indian Point 1 and at Nuclear Fuel Services, Inc., have led to the discovery of several facility-related radioisotopes in environmental media. These two facilities are of comparatively early vintage, have produced slightly larger amounts of waste materials, and have been the subject of more comprehensive studies than others in the state. Dose consequences to hypothetical persons and to populations within 50 miles of the facilities are addressed. It should be stressed that all individual doses presented are hypothetical. Doses via the drinking-water and cow's-milk pathways are particularly conservative. In each case these hypothetical doses are at least an order of magnitude or more greater than the known worst case. No excessive exposure levels are known to have existed. All operations resulted in postulated exposure levels well within applicable regulations or guidelines generally being a small percentage of these values. Population doses have been surprisingly consistent through the period of interest. They are insignificant in comparison to the dose of the population of the state from natural or medical sources. (auth)

Atmosphere

Refer also to abstract 6502.

6426 (CONF-750607-9) PRELIMINARY CROSS-SECTION SENSITIVITY ANALYSIS FOR AN AIR-OVER-GROUND ENVIRONMENT. Pace, J. V. III; Bartine, D. E. (Oak Ridge National Lab., Tenn. (USA)). 1974. 4p. Dep. NTIS $4.00.

From American Nuclear Society meeting; New Orleans, Louisiana, USA (8 Jun 1975).

Two-dimensional sensitivity calculations were made for an air-over-ground geometry to determine the effect of air and ground cross-section perturbations on the total neutron and gamma ray dose near the air/ground interface and 400 meters above the ground. ENDF/B 22 neutron and 18 gamma group Version IV cross-sections were used in all computations. The two-dimensional air-over-ground calculations were made with the DOT code using cylindrical geometry. The cylinder had an upper 1300M high region of air and a lower 50 cm deep region of ground. The maximum horizontal range was 1500M and the source height was 50M. A weapon fission source spectrum was input as a point source in the forward DOT run. For the two adjoint runs, the adjoint source consisting of the Auxier–Snyder neutron dose factors and the Claiborne–Trubey gamma dose factors, were input at heights of 0.5M and 415M and ground ranges of 605M and 485M, respectively; thus keeping the slant range approximately constant. The VIP code provided the integral of the adjoint and forward flux over angle to the SWANLAKE code which calculated the sensitivity of the total neutron and gamma ray dose to changes in the cross-sections as functions of position, energy, and element. (auth)

6427 (K-L-6346) URANIUM HANDLING AT THE OAK RIDGE GASEOUS DIFFUSION PLANT. Bailey, J. C. (Oak Ridge Gaseous Diffusion Plant, Tenn. (USA)). [nd]. 7p. (CONF-750445-1). Dep. NTIS $4.00.

From conference on occupational health experience with uranium; Arlington, Virginia, USA (28 Apr 1975).

Operations carried out in the Oak Ridge Gaseous Diffusion Plant are described in general terms, and the characteristics of uranium hexafluoride as these relate to radiation exposure potentials are summarized. The relatively simple procedures for controlling exposures to uranium materials are discussed. Radiation exposure experience as indicated by film-badge monitoring, urinalysis results, and whole-body counting is summarized. (auth)

6428 (ORNL-tr-2979) HEALTH-PHYSICS INVESTIGATIONS IN THE NEIGHBORHOOD OF COAL-FIRED POWER PLANTS. Polgar, E.; Kurczne-Csiky, I. Translated from Egeszsegtudomany; 14: 188-191(1970). 10p. Dep. NTIS $4.00.

As a result of burning coals with a high uranium content, small amounts of ^{226}Ra are released daily at a constant rate into the environment of the Ajka and Inota Power Plants, Hungary. Studies were carried out in the neighborhood of the power plants in order to determine the extent of radioactive contamination caused by the generation and distribution of the fly ash. During the systematic radiological studies a large body of useful information was collected on conventional environmental control tests that yield the most satisfactory results. Approximation analyses based on the total beta activity played an important role. (CH)

Soil

Refer also to abstracts 6082 and 6367.

6429 (CONF-750503-15) CYCLING OF ^{137}Cs IN SOIL AND VEGETATION OF A FLOOD PLAIN 30 YEARS AFTER INITIAL CONTAMINATION. Dahlman, R. C.; Van Voris, P. (Oak Ridge National Lab., Tenn. (USA)). 1975. 30p. Dep. NTIS $4.50.

From 4th national symposium on radioecology; Corvallis, Oregon, USA (12 May 1975).

Distribution of radiocesium was determined in soil and vegetation components of a flood plain contaminated by Manhattan Project operations in 1944. Thirty years after contaminated waste effluents were deposited in a temporary holding basin, practically all the soil ^{137}Cs was still within 60 cm of the soil surface. Maximum ^{137}Cs concentrations occurred in the 12- to 22-cm horizon. Concentrations throughout the flood plain were variable; maximum levels of ^{137}Cs exceeded 20,000 pCi/g; intermediate levels of 5,000 to 20,000 pCi/g were encountered along the watercourse, and concentrations less than 5,000 pCi/g were found along the flood plain margins. Relative concentrations in soil, roots, and above-ground vegetation (expressed as ratios on a gram per gram basis) were 0.6 for root/soil, 0.05 for above-ground vegetation/soil, and 0.03 for above-ground vegetation/roots. Ratios ranged from 0.001 to 0.53 for all species, and average ratios for the 30-year post-contamination study showed that the relative ^{137}Cs distribution between plants and soil has not changed significantly from distributions reported 15 years ago (plant/soil ratio 0.05 vs 0.03 by Auerbach et al., 1959). The results also indicated that ratios were higher at low soil-^{137}Cs concentration. Thus, when soil and environmental conditions remain unchanged over a 30-year period, the relative concentration of ^{137}Cs between plants and soil does not appear to change significantly as a function of time. (auth)

6430 (CONF-750530-1) APPLICATION OF A SOIL AND GROUND-WATER POLLUTANT-TRANSPORT MODEL. Reeves, M.; Duguid, J. O. (Oak Ridge National Lab., Tenn. (USA)). 1975. 15p. Dep. NTIS $4.00.

From 2nd national conference on complete water use; Chicago, Illinois, USA (4 May 1975).

A general two-dimensional model was developed for simulation of saturated-unsaturated transport of radionuclides in ground water. This model is being applied to the transport of radionuclides from waste-disposal sites, where field investigations are currently under way to obtain the necessary parameters. A zero-order simulation of a waste-disposal trench is presented. Estimated values of the soil properties have been used since very limited experimental information is available at the present time. However, as more measured values become available from field studies, the simulation will be updated. The end product of this research will be a reliable computer model useful both in predicting future transport of radionuclides from buried waste and in examining control measures if they are shown to be necessary. (auth)

6431 (NRC/CNR-TT-1783) ACTION OF ELECTRIC CURRENTS ON THE MOVEMENT OF URANIUM IN ROCKS. Coppens, R. Translated by Y. Peluso from Compt. Rend.; 258: No. 4, 1275-1277(1964). 6p. Dep. NTIS (US Sales Only) $4.00.

An electric current passing through a thin section of humid granite produces a definite decrease in the radioactivity of certain microscopic occlusions. In view of the long duration of geological phenomena, the question arises whether natural currents, however weak, could not activate and direct the movements of some metals present in rocks, by electroosmosis or by electrolysis. (auth)

6432 EXPERIMENTAL STUDY OF STRONTIUM-90 MIGRATION IN THE SOILS OF FOREST BIOGEOCOENOSES. Molchanova, I. V.; Kulikov, N. V.; Piskunov, L. I. (Ural Science Center, Sverdlovsk, USSR). Sov. J. Ecol. (Engl. Transl.); 4: No. 5, 416-419(1973).

Translated from Ekologiya; 4: No. 5, 61-65(1973).

The migration and distribution of ^{90}Sr in forest soils was studied in adjacent sections of a mountain landscape by introducing radionuclide into the forest floor and by analyzing global radioactive fall-out. The area of ^{90}Sr dissemination within the soil profile of forest biogeocoenoses was found to be larger in the middle part of the slope and at its foot than at the top of the ridge. The radionuclide's vertical distribution in soils is satisfactorily approximated by an exponential function with both artificial and global contamination of biogeoccenoses. (auth)

6433 INFLUENCE OF THE CONDITIONS OF SOIL MOISTURE ON THE PASSAGE OF STRONTIUM-90, CESIUM-137, AND CERIUM-144 FROM THE SOIL INTO SOLUTION. Kulikov, N. V.; Molchanova, I. V.; Karavaeva, E. N. (Ural Scientific Center, Sverdlovsk, USSR). Sov. J. Ecol. (Engl. Transl.); 4: No. 4, 320-323(1973).

Translated from Ekologiya; 4: No. 4, 57-62(1973).

It was shown experimentally that with increasing soil moisture content the amounts of Cs^{137} and Ce^{144} in the equilibrium solution increase sharply, while the content of Sr^{90} changes less substantially. It has been suggested that the seasonal drops in the soil moisture content under natural conditions are among the causes of the equalization of the rates of vertical migration of the radionuclides studied in the soil. (auth)

Water

6434 (CONF-750413-P2, pp IV.119-IV.121) MATHEMATICAL MODELING OF TRANSPORT PROCESSES IN AQUATIC SYSTEMS. Trent, D. S. (Battelle Pacific Northwest Labs., Richland, WA). 1975.

From ANS computational methods in nuclear energy; Charleston, South Carolina, USA (15 Apr 1975).

In proceedings of the conference on computational methods in nuclear engineering. Vol. II. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.; Energy Research and Development Administration, Aiken, S. C. (USA). Savannah River Operations Office).

The various levels of approximation and application of mathematical modeling techniques which are applied to transport processes of chemical, biological, and thermal wastes, and radioactive effluents in rivers, lakes, estuaries, coastal seas, and the open ocean are reviewed. In addition, the various numerical techniques in general use are discussed as applied to the velocity-pressure and vorticity-stream function equation sets. (auth)

6435 (CONF-750413-P2, pp IV.123-IV.138) POLLUTANT TRANSPORT IN NATURAL STREAMS. Buckner, M. R.; Hayes, D. W. (E. I. du Pont de Nemours and Co., Aiken, SC). 1975.

From ANS computational methods in nuclear energy; Charleston, South Carolina, USA (15 Apr 1975).

In proceedings of the conference on computational methods in nuclear engineering. Vol. II. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.; Energy Research and Development Administration, Aiken, S. C. (USA). Savannah River Operations Office).

A mathematical model has been developed to estimate the downstream effect of chemical and radioactive pollutant releases to tributary streams and rivers. The one-dimensional dispersion model was employed along with a dead zone model to describe stream transport behavior. Options are provided for sorption/desorption, ion exchange, and particle deposition in the river. The model equations are solved numerically by the LODIPS computer code. The solution method was verified by application to actual and simulated releases of radionuclides and other chemical pollutants. (auth)

6436 (CONF-750503-7) SPECIFIC ACTIVITY AND CONCENTRATION MODEL APPLIED TO CESIUM-137 MOVEMENT IN A EUTROPHIC LAKE. Vanderploeg, H. A.; Booth, R. S.; Clark, F. H. (National Oceanic and Atmospheric Administration, Ann Arbor, Mich. (USA). Great Lakes Environmental Research Lab.; Oak Ridge National Lab., Tenn. (USA)). 1975. 31p. Dep. NTIS $4.75.

From 4th national symposium on radioecology; Corvallis, Oregon, USA (12 May 1975).

A linear systems-analysis model which simulates time-dependent dynamics of specific activity and concentration of radiocesium in lake ecosystems was applied to a shallow, eutrophic lake that had received a pulse input of ^{137}Cs. Best estimates of transfer coefficients for abiotic compartments (sediment, interstial water, and water) and macrophyte compartment which control mass balance of cesium in water were determined by tuning our initial estimates of the transfer coefficients to observed data on ^{137}Cs concentrations and contents of these compartments. In most cases, the optimized transfer coefficients of the abiotic compartments were not greatly different from our independently-derived initial estimates, and the simulations for optimized coefficients were close to those based on initial estimates. The simulations of ^{137}Cs concentration in water predicted by the optimized transfer coefficients were used to derive ^{137}Cs kinetics in biota other than macrophytes. In general, model simulations were close to concentrations observed in the biota. The agreement between ^{137}Cs concentrations and simulations in bottom invertebrates supported our assumption that bottom sediments are not a major source of Cs to the biota. (auth)

6437 (SFL-A-20) ROLE OF HUMIC SUBSTANCES IN THE TRANSPORT OF RADIONUCLIDES. Salo, A.; Saxen, R. (Institute of Radiation Physics, Helsinki (Finland)). Dec 1974. 32p. Dep. NTIS (U. S. Sales Only) $4.75.

The present study was undertaken in order to elucidate the possible role of humic substances in the transport of radionuclides in water. The first task was to find suitable methods to characterize humic substances from different sources and to find analytical methods sensitive enough for the determination of metals bound to humic substances of different molecular size groups. From the methodological point of view the use of the Pt standard as a measure of the humus concentration is discussed, as are the fractionation of humic substances into different molecular size groups, the atomic absorption and x-ray fluorescence methods to determine the stable elements bound to these fractions, and the use of radionuclides as tracers for organic bound metals. The molecular size distribution of humic substances in some surface water samples and samples from Bothnian Bay, Finland, and the use of distribution coefficients (K_d) to characterize water samples containing humic substances were studied by gel chromatography. The effect of salinity on distribution coefficients, the seasonal variation of the K_d values, and the distribution of iron, manganese, zinc, copper, strontium, and cesium into different molecular size groups of the humic substances are discussed. (auth)

6438 (UCSD-34P84X9) MARINE GEOCHEMISTRY RESEARCH. Progress Report. Goldberg, E. D. (California Univ., La Jolla, San Diego (USA). Dept. of Chemistry). 11 Mar 1975. Contract AT(04-3)-34. 6p. Dep. NTIS $4.00.

The $^{239+240}Pu$ and ^{210}Pb content of the coastal deposits off southern California and Baja California was measured. A continuing increase of the $^{239+240}Pu$ concentration was detected. The primary source of these isotopes was identified as crustal rock debris mobilized by winds to the marine environment. ^{238}Pu from the burned up SNAP device was detected in the Santa Barbara Basin. A substantial fraction of the Pb and Pu isotopes in atmospheric dusts is water soluble. The significance of these in the explanation of ^{90}Sr fallout is discussed. Preliminary results on ^{228}Ra geochronology in the San Clemente Basin are reported. (JSR)

6439 ATOMIC WEAPON TRITIUM HYDROLOGY IN A GROUND WATER BODY WITH FREE GROUND WATER SURFACE. Atakan, Y. Heidelberg; Heidelberg Univ. (1972). 101p. (In German). INIS.

Thesis.

The distribution of atomic weapon tritium in a ground water body with sand matrix and free surface was investigated through the years 1969-1972 in a pine forest of the Rhine Valley near Heidelberg. Additional information was gained from the application of conventional hydrological methods. The tritium content of groundwater (i.e., the amount of tritium in a vertical column of unit area), showed only slight spatial variations (5 to 10%) while the spatial variations of the T-concentration in any distinct depth layer were somewhat larger (about 20%). (GE)

Ecosystems and Food Cycles

Refer also to abstracts 6789 and 6874.

6440 (CONF-750503-16) REVIEW OF THE ECOLOGICAL PARAMETERS OF RADIONUCLIDE TURNOVER IN VERTEBRATE FOOD CHAINS. Kitchings, T.; DiGregorio, D.; Van Voris, P. (Oak Ridge National Lab., Tenn. (USA)). 1975. 32p. Dep. NTIS $4.75.

From 4th national symposium on radioecology; Corvallis, Oregon, USA (12 May 1975).

Ecological studies of radionuclides in the environment have a long tradition in developing the capability to identify and predict movement and concentration of nuclides in agronomic food chains leading to man. Food chain pathways and transfer coefficients for the non-agronomic portions of natural and managed ecosystems characteristic of affected habitats adjacent to nuclear facilities have not been adequately characterized to establish reliable dispersion models for radionuclide releases. This information is

necessary in order to assess the impact that such installations will have on the biota of natural ecosystems. Since food chains are the major processes transferring elements from one trophic level to another in terrestrial ecosystems, information is needed on the food-chain transfer pathways, bioconcentration by each trophic component, and turnover rates by receptor organisms. These data are prerequisite inputs for food-chain transport models and can be correlated with species characteristics (e.g., body weight and feeding habits), to provide indices for predictive dispersion calculations. Application of these models for radionuclide transfer can aid in the assessment of radioactive releases from nuclear reactor facilities to terrestrial non-agronomic food chains. (auth)

6441 (CONF-750503-17) SPATIAL DISTRIBUTION OF RADIONUCLIDES IN LAKE MICHIGAN BIOTA NEAR THE BIG ROCK POINT NUCLEAR PLANT. Wahlgren, M. A.; Yaguchi, E. M.; Nelson, D. M.; Marshall, J. S. (Argonne National Lab., Ill. (USA)). 1974. Contract W-31-109-Eng-38. 15p. Dep. NTIS $4.00.

From 4th national symposium on radioecology; Corvallis, Oregon, USA (12 May 1975).

A survey was made of four groups of biota in the vicinity of the Big Rock Point Nuclear Plant near Charlevoix, Michigan, to determine their usefulness in locating possible sources of plutonium and other radionuclides to Lake Michigan. This 70 MW boiling-water reactor, located on the Lake Michigan shoreline, was chosen because its fuel contains recycled plutonium, and because it routinely discharges very low-level radioactive wastes into the lake. Samples of crayfish (Orconectes sp.), green algae (Chara sp. and Cladophora sp.), and an aquatic macrophyte (Potamogeton sp.) were collected in August 1973, at varying distances from the discharge and analyzed for $^{239,240}Pu$, ^{90}Sr, and five gamma-emitting radionuclides. Comparison samples of reactor waste solution have also been analyzed for these radionuclides. Comparisons of the spatial distributions of the extremely low radionuclide concentrations in biota clearly indicated that ^{137}Cs, ^{134}Cs, ^{65}Zn, and ^{60}Co were released from the reactor; their concentrations decreased exponentially with increasing distance from the discharge. Conversely, concentrations of $^{239,240}Pu$, ^{95}Zr, and ^{90}Sr showed no correlation with distance, suggesting any input from Big Rock was insignificant with respect to the atmospheric origin of these isotopes. The significance of these results is discussed, particularly with respect to current public debate over the possibility of local environmental hazards associated with the use of plutonium as a nuclear fuel. (auth)

6442 (IRS-W-13) REASSESSMENT OF THE PARAMETERS USED TO PREDICT THE ENVIRONMENTAL TRANSPORT OF ^{131}I FROM AIR TO MILK. A Supplement to IRS-W-6. Hoffman, F. O. (Institut fuer Reaktorsicherheit der Technischen Ueberwachungs-Vereine e.V., Koeln (F. R. Germany)). Apr 1975. 28p. Dep. NTIS (US Sales Only) $4.50.

Assessments of the air to milk transport of $^{131}I_2$ are generally based on the estimate of an areal deposition on pasture and the subsequent transfer from this contaminated area into milk. These assessments may be subject to substantial error because of the uncertainty involved in the interpretation and use of values published for the deposition velocity, the initial vegetation retention factor, and the vegetation to milk transfer factor. Most of this uncertainty is derived from the fact that values for these transfer factors may vary considerably with the height, growth form, areal distribution and density of vegetation. It is therefore suggested that air to milk transport assessments be based upon the estimate of deposition per unit vegetation mass (dry weight) rather than deposition per unit area ground in order to reduce the error brought about by differences in vegetation density. An air to milk transfer factor of about 5000 ($Ci/l : Ci/m^3$) for $^{131}I_2$ under equilibrium conditions is proposed as the result of performing an assessment based upon this method and correcting previous estimates. It is concluded that much of the remaining uncertainties involved with the assessment of the environmental transport of radioiodines released from the nuclear industry can only be resolved through site-specific monitoring of the various chemical species and physical forms of radioiodine, and the investigation of their behavior during atmospheric dispersion and ecological transport. (auth)

6443 (RLO-2227-T12-53) RADIOACTIVITY IN MARINE ORGANISMS OF THE NORTHWEST COAST OF BAJA CALIFORNIA. Nishikawa, K. K.; Larsen, I. L. (Oregon State Univ., Corvallis (USA). School of Oceanography). 1974. 16p. (In Spanish). (CONF-750221-1). Dep. NTIS $4.00.

From conference on fisheries biology; Ensenada, Mexico (16 Feb 1975).

As a contribution to the establishment of baseline values for marine pollution along the coast of Mexico, studies were made regarding the radioactivity in mussels (Mytilus californianus) and barnacles (Pollicipes polymerus) of the Northwestern coast of Baja, California. These organisms were selected as biological monitors because they are widely distributed, abundant, sessile, easily collected, and are known concentrators of radionuclides. Measurements of total radioactivity in samples was made using scintillation counters. Results of recently analyzed samples are compared with previously reported values. Levels of radioactivity have decreased considerably over the past decade. Comparisons with other geographical areas are presented. (auth)

6444 (UH-226X10) ENEWETAK MARINE BIOLOGICAL LABORATORY 1973-1974 ANNUAL REPORT. Final Report. (Hawaii Univ., Honolulu (USA)). 1974. Contract AT(29-2)-226. 61p. Dep. NTIS $6.25.

Brief summaries are presented of ecological studies carried out at Enewetak from July 1973 through June 30, 1974. Data are included on the content of ^{90}Sr in the skeleton of coral. Other studies included measurements of the chemical composition of 60 marine animals; and the growth rate, interactions of prey populations, food supply, food chains, and population dynamics of communities of crustaceans, molluscs, corals, sponges, algae, reef fishes, and shore birds. (CH)

6445 RADIORUTHENIUM IN MARINE ORGANISMS. The Physico-Chemical Form of ^{106}Ru and its Uptake by Marine Organisms. Ishikawa, M. (National Inst. of Radiological Sciences, Chiba (Japan)). Kagaku No Ryoiki; 28: No. 5, 404-410(May 1974). (In Japanese).

The accumulation of ruthenium in organisms was discussed mainly in relation to the physico-chemical morphology. The differences in the organic concentration of ruthenium according to chemical form was shown by the fact that the uptake of ruthenium chloride by Mytilus galloprovincialis Lam. was 10 times higher than that of nitrosyl ruthenium nitrate. The chemical form of Ru in sea water was estimated from the electrophoretic behavior, and it was difficult to consider its complex as the same chemical form. In view of the physico-chemical morphological discussion, the fraction of Ru by electrodialysis and organic concentration and the formation and behavior of Ru complex ion species in sea water were examined showing the results that by the uptake of complex ion species by Fucus virsoides DON Ag. and Hizikia fusiforme, the concentrating tendency of cation species is 5 to 10 times higher than that of anion species, and complex iron species in positive charge contribute more to organic concentration. These chemical behaviors of Ru in sea water are thought to indicate the relation to the biologic pollution of ^{106}Ru. (JA)

6446 USE OF THE PRINCIPLES AND METHODS OF RADIOECOLOGY IN SOLVING SOME CURRENT PROBLEMS OF MAN'S EFFECT ON THE ENVIRONMENT. Aleksakhin, R. M. (Lab. of Forest Science, Moscow). Sov. J. Ecol. (Engl. Transl.); 4: No. 4, 315-319(1973).

Translated from Ekologiya; 4: No. 4, 51-56(1973).

The use of the methods and achievements of radioecology in the study of the problem of man's effect on the environment and migration of chemical elements in biogeocenoses is discussed. An ecological evaluation of the expansion of atomic power plants and of the possible discharge of artificial radioactive substances into the environment is given. The characteristics of the construction of dynamic models of the cycle of radionuclides in biogeocoenoses are described. (auth)

6447 RADIUM-226 IN DIET AND HUMAN BONES IN THE STATE OF RIO de JANEIRO. Lobao, N.; Franca, E. P. (Univ. of Federal, Rio de Janeiro). An. Acad. Bras. Cienc.; 45: No. 3/4, 489-495(1973). (In Portuguese).

The Radioisotopes Laboratory of the Institute of Biophysics, Federal University of Rio de Janeiro, has been carrying on, for several years, an investigation in Brazilian regions of high natural radioactivity, aiming mainly at studying possible biological effects on local populations. The program required radiochemical analysis of some natural radionuclides of biological interest, among which ^{226}Ra is the most outstanding. Due to the low level of radium environmental and biological samples, the analytical method chosen for ^{226}Ra was that of radon emanation, which, because of its specificity and its high sensitivity, allows ^{226}Ra determination down to the order of 0.01 pCi. The ^{222}Rn emanation method consists of three basic systems: collection system, in which radon is adsorbed on activated charcoal at -80°C; transfer system, in which radon is transferred to a scintillation flask; and radioscintillometric counting system for alpha-particle detection. Experiments were carried on to choose the best chemical treatment of samples so as to prevent losses of ^{226}Ra on account of insolubilization. It was concluded that, after dissolving the sample ashes in acids, addition of di-sodium ethylenediaminetetraacetic acid (EDTA) at pH 10 to 11, as a complexing agent, assured the

greatest efficiency in recovering radon from the radium in the solution. In this paper, the authors present results of ^{226}Ra analysis in human bones from a sample of Rio de Janeiro population and in foodstuff produced in areas of normal radioactivity. The average results found in human bones were 0.035 ± 0.014 pCi per gram of ashes and 0.091 ± 0.037 pCi per gram of calcium. These values are 2.3 to 3.5 fold higher than world averages. In foodstuff, elevated concentrations of ^{226}Ra were observed in some staple food of the Brazilian diet such as manioc, potatoes, manioc flour, and beans. The high levels of ^{226}Ra found in human bones are probably due to the high Ra/Ca in the diet of the studied population. Some important components in the basic diet have elevated ^{226}Ra content and the daily intake of calcium is lower than the one observed in some northern countries. (auth)

Radiometric Techniques

Refer also to abstracts 5868 and 6941.

6448 (CENA-BC-017) GENERALIZATION OF SOIL-WATER MOVEMENT. 2. Vertical Infiltration. Libardi, P. L.; Reichardt, K. (Centro de Energia Nuclear na Agricultura, Piracicaba (Brazil)). Apr 1974. 16p. (In Portuguese). INIS.

The process of infiltration of water into soils is studied with the objective of finding general soil water movement equations that would describe the process in different soils. With the aid of a generalization constant and of dimensionless variables a generalization was possible for vertical infiltration. Five soils of the state of Sao Paulo have been used. Measurements of water contents and bulk densities were made by gamma attenuation. (INIS)

6449 LEAD ISOTOPE RATIOS AND POSSIBLE ORIGINS OF KUROKO DEPOSITS. Sato, K. (Tokyo Univ. (Japan)). Chikyu Kagaku; 7-8: No. 1, 39-41(Jun 1974). (In Japanese).

The isotope ratio of lead is the result of summing up isotope evolution in various past environments of the lead. The lead in Kuroko (black ore) deposits shows almost same isotopic features as those of the lead in other vein-like deposits distributing over green-tuff regions, namely the variation of isotope ratio is relatively small, the isotope ratio shows remarkable similarity to that of the lead in high-alumina basalt and deep-sea sediment around Japan deep, and the lead is less radiogenic as compared with the lead to Cenozoic mineralization outside Japan. The isotopic similarity of deposits to igneous rocks and deep-sea sediment shows that both magma origin and earth's crust substance origin cannot be denied as well as sea-water origin, accordingly only the reference to isotope ratio cannot be effective means to investigate into the origin of lead. However, the explanation on the isotopic features so as to be in harmony with geological background and geophysical features of Japan archipelago. Young deposits are expected to show large deviation in radiogenic degree and J-type anomaly. Since Kuroko is a sort of strata-bound deposits, the third feature described before shows that it originates from somewhat different evolution environment from old strata-bound deposits, proper to Japan and her peripheral regions. (JA)

6450 ^{14}C AGE OF HUMUS LAYER IN VOLCANIC ASH SOIL IN MAMIANA, UTSUNOMIYA CITY AND SHIMOKUSAWA, SAGAMIHARA CITY. ^{14}C Age of Japanese Quaternary Strate (99). Shoji, S.; Yamada, I.; Masui, J. (Tohoku Univ., Sendai (Japan). Faculty of Agriculture). Chikyu Kagaku; 28: No. 4, 149-150(Jul 1974). (In Japanese).

In the flat areas around Utsunomiya City and Sagamihara City, the uppermost part of Tachikawa loam is covered with thick humus layer of 1 m or more. The weathering process of primary minerals in accumulating volcanic ash soil was studied. The weathering of mineral particles progressed rapidly from a certain depth in both humus layers. Therefore, in order to elucidate the relation between the weathering condition and age of mineral particles, it was decided that humic acid would be extracted and submitted to the measurement of ^{14}C age. In the section at the sampling point in Utsunomiya, humus content was 15 to 20% down to the depth of 140 cm, and in Sagamihara, it was about 15% to the depth of 100 cm. Sampling was carried out at 70 cm where the weathering of primary minerals progressed rapidly, on May 16-17, 1970. Measurement was undertaken by Professor Kigoshi, and the ^{14}C age of the sample in Utsunomiya was 3,920 ± 130 years BP, while that in Sagamihara was 4,060 ± 140 years BP. (JA)

6451 ISOTOPIC STUDIES ON OIL AND NATURAL GAS FIELDS IN JAPAN. Nakai, N.; Yoshida, Y. (Nagoya Univ., (Japan). Faculty of Science); Ando, N. Chikyu Kagaku; 7-8: No. 1, 87-98(Jun 1974). (In Japanese).

Methane, crude oil and the associated water from oil and neutral gas fields in Japan were analyzed isotopically. In all of natural gas fields studied, gases occur with water in sand and gravel beds of Quaternary to Tertiary, consisting mainly of CH_4, CO_2, N_2 and Ar. $\delta^{13}C$ values of methane are distributed in a rather narrow range from −64 to −75‰ relative to PDB. Those of CO_2 in gas phase are in ranges from +2.0 to −21.2‰ and carbonate materials dissolved in water from +9.3 to −7.1‰. For all of natural gas well studied, CH_4 was most depleted in ^{13}C, whereas $CO_2 + HCO_3^- + CO_3^=$ in the associated water was most enriched in ^{13}C. Carbon isotopic fractionation between CH_4 and CO_2 varies linearly with temperature of associated water. The isotopic temperatures calculated by using Bottinga's fractionation factor agree rather well with temperatures of associated water (13 to 59°C) measured at the ground surface. It can be concluded from these results that CH_4 and coexisting CO_2 produced by unidirectional reactions reached an isotopic exchange equilibrium through enzyme reactions. This suggests bacterial processes of gas productions. Hydrogen isotopic compositions of associated waters of natural gases vary widely from +1.9 to −82.2‰ relative to SMOW, depending on sedimentary environments of gas reservoirs marine and fresh water. δ D values of CH_4 range from −148 to −239‰. A linear relationship for δ D values was found between CH_4 and the coexisting water throughout all natural gas fields. (auth)

6452 K-Ar AGES OF THE ROSEKI DEPOSITS IN THE ABU DISTRICT, YAMAGUCHI PREFECTURE. II. Study on the Roseki Deposits in the Abu District. Shibata, K.; Kamitani, M. (Geological Survey of Japan, Kawasaki, Kanagawa). Chishitsu Chosasho Geppo; 25: No. 7, 323-330(Jul 1974). (In Japanese).

K-Ar age determinations were carried out on four samples from the Uku mine and its vicinity, Yamaguchi Prefecture. The muscovites from the hydrothermally altered zone in the Fukuga Formation of the Abu Group, which is geologically correlated with the Late Cretaceous Nohi and Takada rhyolites, yield K-Ar ages of 81.9 and 82.4 m.y. The ages indicate the time of formation of the Roseki deposits. The pegmatite in the biotite granite that intrudes the Fukuga Formation yields a muscovite age of 79.0 m.y. All these ages agree with the stratigraphically estimated ages of the rocks. The whole-rock age of 65.6 m.y. on the lenticular pumice from the rhyolite welded tuff in the uppermost member of the Fukuga Formation is younger than the estimated age, probably due to argon loss by devitrification and alteration. From the close spatial relationship between the hydrothermally altered zone and the biotite granite and the similarity in their K-Ar ages, it is interpreted that the Roseki deposits have been formed in close connection with intrusion of the granite. (auth)

6453 STRONTIUM ISOTOPE RATIOS IN VOLCANIC ROCKS FROM THE NORTHWESTERN PART OF THE HELLENIC ARC. Pe, G. G. (Patras Univ., Greece). Chem. Geol.; 15: No. 1, 53-60(Feb 1975).

$^{87}Sr/^{86}Sr$ ratios have been determined in fifteen volcanic rocks from the northwestern part of the Hellenic arc. They range from 0.7041 to 0.7134. There is no apparent correlation of strontium isotope values with any major chemical component or with Rb/Sr ratios. The $^{87}Sr/^{86}Sr$ ratios appear to increase in a general way with increasing depth to the Benioff zone. The strontium isotope ratios are higher than from most island arcs; this is believed to be due to contamination. (NL)

6454 WATER DYNAMICS IN THE TROPICAL FERRUGINOUS SOILS OF DUNE ORIGIN AT TARNA AND APPLICATION TO MILLET, GROUNDNUT AND A BARE SOIL. Charoy, J. (Institut de Recherches Agronomiques Tropicales et des Cultures Vivrieres, 75-Paris (France)). Agron. Trop. (Paris); 29: No. 8, 821-830 (1974). (In French).

The good water-holding capacity of the sandy dune soils was shown. The water requirements of millet and groundnut are calculated over a year with normal rainfall. (FR)

6455 OPTICAL DETECTION OF FOSSILE FISSION TRACKS IN MINERALS OF THE PRECAMBRIAN ERA. Hardev Singh Virk; Sohan Lal Kaul (Punjabi Univ., Patiala (India). Dept. of Physics). Compt. Rend., Ser. A, B; 279: No. 18, 477-478(28 Oct 1974). (In French).

The fossile fission tracks induced by the spontaneous decay of ^{238}U, and contained in mica minerals (muscovite and biotite) were detected after suitable scraping. This investigation is useful for estimating uranium content in minerals and then their age. (FR)

6456 RADIOCARBON DATES OF NEOLITHIC-CHALCOLITHIC SAMPLES. Agrawal, D. P.; Kusumgar, S. (Physical Research Lab., Ahmedabad, India). Curr. Sci. (India); 44: No. 9, 298-300(5 May 1975).

The ^{14}C dates from the neolithic sites of Bihar, Karnataka,

and some Harappan and allied sites of Rajasthan, Punjab, and Gujarat are reported. (LK)

Site Surveys

Refer also to abstracts 6444, 6466, and 6874.

6457 (DP-1387) DISPERSION OF SMALL PARTICLES IN A TORNADO. Pepper, D. W. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.). May 1975. Contract AT(07-2)-1. 23p. Dep. NTIS $4.00.

Based on 22 years of tornado statistics for South Carolina and Georgia, the probability of a tornado of Class F3 or greater striking a point at the Savannah River Plant is calculated to be approximately 14 x 10^{-5} per year. These statistics show that Class F3 tornados (0.56-psi pressure drop and winds of 158 to 206 mph) are the most frequently occurring but cause only 23 percent of the damage compared with all classes of tornadoes. F4 tornadoes (1.10-psi pressure drop and winds of 207 to 260 mph) constitute only 20 percent of the total, but cause 63 percent of the damage. A Gaussian diffusion model is used to calculate the ground level concentration (ratio of concentration to source mass chi/Q) as a function of distance downwind should a tornado strike a point within the Savannah River Plant (SRP). The particles released to the atmosphere are assumed to be 1 to 3-mu m diameter. For the calculations, two cases of possible small particle pickup are considered. In Case I a unit source of small particles is assumed to be injected into the tornado core and transported into the thunderstorm. In Case II, the cluster of particles is assumed to exit the side of the tornado core below the thunderstorm cloud. Several different stabilization heights within the thunderstorm, different horizontal wind speeds, and different turbulence dissipation rates are assumed for the calculations. (auth)

6458 (ERDA-34) RADIOLOGICAL RESURVEY OF FOOD, SOIL, AIR, AND GROUNDWATER AT BIKINI ATOLL, 1972. Lynch, O. D. T. Jr.; McCraw, T. F.; Nelson, V. A.; Moore, W. E. (USAEC Nevada Operations Office, Las Vegas; USAEC, Washington, D. C.; Washington Univ., Seattle (USA). Lab. of Radiation Ecology; National Environmental Research Center, Las Vegas, Nev. (USA)). Feb 1975. 33p. Dep. NTIS $4.00.

Results of radiation surveys and radionuclide analyses of samples collected from Bikini Atoll are presented from collections made in November 1971, March 1972, and May 1972. New analyses are also presented for some soil samples collected in June 1970. Predominant radionuclides in soils from Bikini Island are ^{55}Fe, ^{60}Co, ^{90}Sr, ^{125}Sb, ^{137}Cs, ^{155}Eu, ^{207}Bi, ^{238}Pu, ^{239,240}Pu, and ^{241}Am. The concentrations observed in May 1972 soil samples are considerably lower than levels observed in previous surveys, due to the mixing effect of rehabilitation efforts in progress on Bikini Island. In crater sediments, ^{60}Co, ^{102}Rh, ^{137}Cs, ^{155}Eu, ^{207}Bi, ^{238}Pu, ^{239,240}Pu, and ^{241}Am are the predominant radionuclides. In fish, ^{40}K, ^{55}Fe, ^{60}Co, ^{90}Sr, ^{137}Cs, and ^{207}Bi are predominant, while in land plants ^{40}K, ^{90}Sr and ^{137}Cs are the radionuclides of interest. The major radionuclides in coconut crabs were ^{40}K, ^{60}Co, ^{90}Sr, ^{95}Nb, and ^{137}Cs. The single bird sample showed low levels of ^{40}K, ^{60}Co, ^{106}Ru-^{106}Rh, and ^{137}Cs. Large-volume filter sorption bed marine water samples indicated that ^{60}Co, ^{137}Cs, ^{155}Eu, and ^{241}Am are associated with suspended particulates, while ^{207}Bi was mostly in the soluble form. A difference was observed in ebb vs. flood-tide samples, indicating that Bikini Atoll waters are a source of these radionuclides. Fresh water samples from a well on Bikini Island indicated that ^{137}Cs and ^{60}Co are associated with the soluble fraction. Dose estimates for internal and external radionuclides prepared by Gustafson, utilizing the 1967 and earlier data, would appear to be valid for the 1971 and 72 collections as well. (auth)

6459 (NERC-LV-539-39) ENVIRONMENTAL MONITORING REPORT FOR THE NEVADA TEST SITE AND OTHER TEST AREAS USED FOR UNDERGROUND NUCLEAR DETONATIONS, JANUARY THROUGH DECEMBER 1974. (National Environmental Research Center, Las Vegas, Nev. (USA)). May 1975. 129p. Dep. NTIS $5.45.

During 1974, the monitoring of gamma radiation levels in the environs of the NTS was continued through the use of an off-site network of radiation dosimeters and gamma-rate recorders. Concentrations of radionuclides in pertinent environmental media were also continuously or periodically monitored by established air, milk, and water sampling networks. Before each underground nuclear detonation, mobile radiation monitors, equipped with radiation monitoring instruments and sampling equipment, were on standby in off-NTS locations to respond to an accidental release of airborne radioactivity. A total of about 707 curies (Ci) of radioactivity, primarily ^{133}Xe, was reported as being released intermittently throughout the year. The only off-NTS indications of this radioactivity from test operations were concentrations of ^{133}Xe measured in air samples collected at Beatty and Diablo, Nevada. The concentrations at these locations when averaged over the year were less than 0.008 percent of the Concentration Guide of 1 x 10^{-7} microcuries per milliliter (mu Ci/ml) as listed in the ERDA Manual, Chapter 0524, for exposure to a suitable sample of the population. Based upon time-integrated concentrations of ^{133}Xe at these locations, dose calculations, and population information, the dose commitment to persons within 80 km of the NTS Control Point for test operations during this year was estimated to be 0.003 man-rem. All other measurements of radioactivity within the Off-Site Radiological Safety Program were attributed to naturally occurring radioactivity or atmospheric fallout and not related to underground nuclear test operations during this report period. (CH)

6460 (NP-20377) GENERAL ENVIRONMENTAL GUIDELINES FOR EVALUATING AND REPORTING THE EFFECTS OF NUCLEAR POWER PLANT SITE PREPARATION, PLANT, AND TRANSMISSION FACILITIES CONSTRUCTION. Emerson, D. B.; Hopkins, H. T.; Squire, G. R.; Sitek, G. M. (Hittman Associates, Inc., Baltimore, Md. (USA)). Feb 1974. 134p. AIF, Inc. For Atomic Industrial Forum, Inc., Washington, DC.

The various environmental considerations that should be taken into account when describing the expected environmental impacts stemming from nuclear power plant site preparation, and plant and transmission facilities construction are presented. The data provide environmental report writers a uniform and comprehensive guide by which they may satisfy the requirements of Chapter 4 of the U. S. Atomic Energy Commission (AEC) Regulatory Guide 4.2, entitled "Environmental Effects of Site Preparation, Plant and Transmission Facilities Construction." (auth)

6461 (ORO-4180-5) DYNAMICS OF THE RECOVERY OF DAMAGED TUNDRA VEGETATION. Annual Progress Report. Amundsen, C. C. (Tennessee Univ., Knoxville (USA)). 11 May 1975. Contract AT(40-1)-4180. 23p. Dep. NTIS $4.25.

A study, begun in 1971, has been undertaken to determine the environmental factors which affect the recovery of damaged tundra vegetation. A sampling technique was developed in Amchitka Island to allow the rapid acquisition of data on species presence and frequency across areas disturbed at various times and in various ways. Attempts were made to sample across all examples of aspect, slope steepness and exposure. The data were analyzed and we concluded that there was no directional secondary succession on the Amchitka tundra, although there was vigorous recovery on organic soils. The study led to recommendations which resulted in a smaller effort than planned to reclaim damaged areas by seeding and fertilizing at a considerable financial saving and without further biological perturbation. Because of the increasing activity on tundra landscape, whether for energy production, or military or other reasons, we are expanding our sampling to other tundra areas. Immediate plans include sampling at Adak Island and Barrow, Alaska. (auth)

Thermal Effluents

Refer also to abstracts 6420, 6434, 8015, 8237, 8253, 8257–8261, 8263–8266, 8271–8297, and 8411.

6462 (ANL/WR-75-1) WATER RESOURCES RESEARCH PROGRAM. Volume I. Measurements of Physical Phenomena Related to Power Plant Waste Heat Discharges: Lake Michigan, 1973–1974. Tokar, J. V.; Zivi, S. M.; Frigo, A. A.; Van Loon, L. S.; Frye, D. E; Tome, C. (Argonne National Lab., Ill. (USA)). Mar 1975. Contract W-31-109-Eng-38. 352p. Dep. NTIS $10.60.

Methodology developed for the prediction of the temporal and spatial extent of thermal plumes resulting from heated discharges as a function of environmental and power plant design and operating conditions is described. Plume temperature measurements acquired from the Point Beach and Zion Nuclear Power Plants, both located on Lake Michigan, during the past several years show the effects of two-unit operation at the plant site. The Zion plant, in contrast to the shoreline surface discharge of the Point Beach station, has offshore submerged outfalls. Measuring techniques discussed include: fluorescent dye studies of the magnitude of lateral and vertical turbulent transport in plume dispersal; simultaneous aerial infrared scanning and in situ boat measurements for thermal plume mapping; a study of the dynamic characteristics of heated discharges; and a review of data from a two-year study of nearshore ambient currents at the Point Beach plant. (CH)

6463 (BNWL-SA-5349) TOXICITY TESTS ON THE COMBINED EFFECTS OF CHLORINE AND TEMPERATURE ON

RAINBOW (SALMO GAIRDNERI) AND BROOK (SALVELINUS FONTINALIS) TROUT. Wolf, E. G.; Schneider, M. J.; Schwarzmiller, K. O.; Thatcher, T. O. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Mar 1975. Contract AT(45-1)-1830. 20p. (CONF-750433-2). Dep. NTIS $4.00.

From Savannah River thermal ecology symposium; Aiken, South Carolina, USA (2 Apr 1975).

Combined biological effects of thermal stress and chlorine on trout were demonstrated utilizing 96 hr TL_{50} flow through toxicity tests. The data illustrate that the combined interaction becomes evident only after rainbow trout acclimated at 5, 10, 15 and 20°C were tested simultaneously at specific test temperatures. It was also determined that the rainbow trout must experience thermal stress greater than 10°C before a combined effect was noted. Fish size, especially for brook trout, influenced sensitivity more than the combined interaction of chlorine and thermal shock. Brook trout larger than 89 mm were significantly less vulnerable to chlorine-temperature toxicity than the smaller fish. Concepts also discussed are the compatibility of findings concerning latent mortality, the primary site of chlorine toxicity, and the reliability of short term, high dose tests that have recently been reported in the literature. (auth)

6464 (EGG-1183-1662) DIGITAL PROCESSING OF INFRARED SCANNER DATA FOR RADIOMETRIC TEMPERATURE ANALYSIS OF THERMAL PLUMES. Langner, D.; Michael, J.; Wright, D. (EG and G, Inc., Los Alamos, N. Mex. (USA)). 1975. Contract AT(29-1)-1183. 8p. (CONF-750609-1). Dep. NTIS $4.00.

From machine processing of remotely sensed data symposium; West Lafayette, Indiana, USA (3 Jun 1975).

A method for digitally reducing thermal plume data obtained from a Bendix infrared thermal mapper is presented. This method includes a distortion removal technique and the calculation of apparent blackbody temperature from the scanner's output film. This method is illustrated using data obtained with a Bendix scanner over the Surry Station nuclear power generating facility located on the James River in Surry, Virginia. (auth)

6465 (EPA-660/3-74-031) ENVIRONMENTAL REQUIREMENTS OF SELECTED ESTUARINE CILIATED PROTOZOA. Borror, A. C. (National Environmental Research Center, Corvallis, Oreg. (USA)). May 1975. 53p. NTIS.

This report addresses species composition and microdistribution of ciliates (Protozoa, Ciliophora) of a tidal marsh at Adams Pt., Great Bay, New Hampshire (1970, 1971) in relationship to temperature, salinity, pH, concentration of oxygen, H_2S, and bacteria, and occurrence of micrometazoa. Accurate counting and precise identification allowed measurement of tidal effects on ciliate abundance and diversity, and the relationship of ciliates to micrometazoa and bacteria. During 1970, we identified 79 species in 175 collections; during 1971, 83 species in 102 collections. Although in general ciliate distribution was not correlated with temperature, salinity, pH, or oxygen concentration, some species were tolerant of anoxic environments. Ciliates differed in distribution between the upper (Spartina patens) and the lower (S. alterniflora) marsh. We measured responses of bacteria and ciliates to the physical and biological changes in a patens-panne pond caused by tidal flushing, and to the flushing of a channel in the lower marsh by several different tidal cycles. (auth)

6466 (NP-20402) SOME ECOLOGICAL STUDIES OF THE LOWER CAPE FEAR RIVER ESTUARY, OCEAN OUTFALL, and DUTCHMAN CREEK, 1971. Copeland, B. J.; Birkhead, W. S. (North Carolina State Univ., Raleigh (USA)). 31 Jan 1972. 110p. North Carolina State Univ., Raleigh.

A survey of the hydrography and biological components of the Cape Fear River Estuary and nearshore ocean off Oak Island was conducted. Species diversity indices were computed from nekton samples and phytoplankton, zooplankton, and benthos samples are being analysed. A computer program was developed whereby data were alphabetized by species, sorted by location, station, and date, and printed. Experiments were conducted to determine the Critical Thermal Maximum of shrimp. Measurements were made on water temperature, salinity, and dissolved oxygen from June through October. (HLW)

6467 (ORNL-4940) TRANSIENT, TWO-DIMENSIONAL, DISCRETE-ELEMENT, FAR-FIELD MODEL FOR THERMAL IMPACT ANALYSIS OF POWER PLANT DISCHARGES IN COASTAL AND OFFSHORE REGIONS. Part I. General Description of the Mathematical Model and the Results of an Application. Eraslan, A. H. (Oak Ridge National Lab., Tenn. (USA). Feb 1975. Contract W-74u5-eng-26. 164p. Dep. NTIS $7.60.

A far-field mathematical model is presented for numerical simulation of short-time (within tidal cycle) transient, two-dimensional temperature distributions in large coastal and offshore regions resulting from the condenser cooling water discharges of power plants. The Eulerian FLIDE (fluid-in-discrete-element) formulation employs the integral forms of the conservation principles for mass and thermal energy in variable-sized discrete elements that span the specific flow region. The contributions of vertical variations of the velocity components and temperature are rigorously incorporated in the development of depth-averaged, two-dimensional energy transport fluxes by spatially integrating the conservation equations over the enclosure surfaces of the discrete elements. The general mathematical formulation considers completely arbitrary, transient oceanic flow conditions, which include periodic tidal, geostrophic, and wind-induced currents, as locally specified inputs to the model. The fundamental differences, both from physical and mathematical considerations, between meso-scale and micro-scale eddy turbulence, shear flow dispersion, and stratification are discussed in detail to establish a realistic formulation of depth-averaged, nonconvective thermal energy fluxes associated with the general turbulent transport phenomenon. The surface heat-transfer effect is formulated according to a short-time model (hourly variations) which approximately incorporates solar irradiation, black body back radiation, evaporation, and convection modes for the conditions of the ocean surface in coastal and offshore regions. The resulting mathematical system of weakly coupled, nonlinear, ordinary differential equations is numerically integrated, from arbitrarily specified initial conditions, by the Runge–Kutta–Gill method with a time step size based on a stability criterion for explicit methods. The general mathematical model is applied to the assessment of the thermal impact of a hypothetical, multiunit generating station in a coastal region where the oceanic flow conditions are assumed to be strictly periodic tidal currents without any appreciable net drift of sufficient duration to remove the heated effluent out of the far-field region. The numerical simulation indicates that the periodic flow conditions cause considerable variations in the temperature distributions during the day and the tidal cycles, which result in severe recirculation and re-entrainment of the heated water between the intakes and the discharges of the different units. This thermal interaction effect ultimately leads to a gradual, long-term increase of the temperatures in the immediate vicinity of the discharge structures and also in the far-field zone, which could cause adverse environmental impact in the coastal region. It is concluded that steady-state near-field studies of the individual discharges are definitely inadequate, and a transient far-field analysis that considers the variations in oceanic flow conditions is essential for the realistic assessment of the thermal impact of a large nuclear power plant in a coastal or offshore region. (auth)

6468 (SREL-3, pp 3-38) THERMAL ECOLOGY PROGRAM. Murphy, J. C.; Esch, G. W.; Gentry, J. B. May 1975.

In Savannah River Ecology Laboratory annual report. (Georgia Univ., Athens (USA). Inst. of Ecology).

Progress is reported in the following areas of research: effects of thermal effluents on body condition, species diversity, reproduction, growth, and parasitism of fish; fish diversity in post-thermal habitats; effects of thermal effluents on snails and aquatic insects; distribution of macrophyte communities along a shore-line temperature gradient; growth and genetic variation in cattail in thermally altered environments; and population dynamics of thermally resistant plants in a swamp receiving reactor effluent. (HLW)

6469 (TID-26780) USING POWER PLANT DISCHARGE WATER IN GREENHOUSE VEGETABLE PRODUCTION. Progress Report. Madewell, C. E.; King, L. D.; Carter, J.; Martin, J. B.; Furlong, W. K. (Tennessee Valley Authority, Muscle Shoals, Ala. (USA)). Jan 1975. 18p. Dep. NTIS $4.00.

The low-grade energy or heat contained in power plant condenser cooling water is considered waste heat. At the TVA Browns Ferry Nuclear Plant, condenser water discharge is calculated to vary from a low of 21°C (70°F) in January to 43°C (110°F) in July and August, for 100 percent once-through cooling. If cooling towers, either evaporative or dry, are used for part or all of the heat rejection, then the temperature of the water increases significantly. For evaporative towers, condenser water temperature would range from 24° to 52°C (75° to 125°F), depending upon the time of year and location. At Browns Ferry, predicted condenser discharge temperatures would range from 43°C (110°F) in January to 51°C (124°F) in July and August, if all of the heat were to be rejected by evaporative cooling towers. For dry cooling towers, the water temperature would be 11° to 22°C (20° to 40°F) higher than the temperature with once-through cooling. One potential method of using waste heat in agriculture is the heating and cooling of greenhouses. The design features of the TVA waste heat research greenhouse at Muscle Shoals, Alabama, the result of cooperative efforts of individuals from a number of disciplines, are described. The engineering system has performed well enough to keep the crops alive and growing. However, modifications are planned to the present house to test variation on the central theme

of heating and cooling with a single contacting device (aspen pads in the present installation) for a specific crop. An important future question to be examined is that of the interface between a large greenhouse installation and a power plant. Of interest are such things as variation of water temperature with load, plant shutdown, water quality and activity monitoring, greenhouse revenue and rate structure, legal liability to commercial lessees, etc. In addition, many questions remain regarding crop marketing and operational economics. The pilot facility, with proper modifications, will continue to provide good horticultural, engineering, and economic guidelines for the design of a larger demonstration facility to be located at an operating power plant. (auth)

6470 EFFICIENT ALLOCATION OF ENVIRONMENTAL ASSIMILATIVE CAPACITY: THE CASE OF THERMAL EMISSIONS TO A LARGE BODY OF WATER. Scherer, C. R. (Univ. of California, Los Angeles). Water Resour. Res.; 11: No. 1, 180-181(Feb 1975).

The economically efficient level of environmental assimilative capacity in the case of thermal electric rejected heat discharges to large lakes subject to temperature standards is considered. A mathematical model relating heated effluent flow rate and "near-field" temperature is used to determine maximum diffusor port size. Diffusor costs are developed as a function of discharge velocity, port size being given. Cooling tower costs are also developed for comparison with diffusor costs in selecting an optimal level of thermal assimilative capacity. The relationship between this selection process and optimal power plant siting models is outlined. It is shown that arbitrarily fixing discharge velocity at some practical level will tend to bias the results of these siting models toward overly conservative use of thermal assimilative capacity. That is, available capacity will not be fully exploited, and the cost of a given level of power output will be greater than is necessary. (auth)

6471 ENERGY REQUIREMENTS OF OUTDOOR BASINS FOR AQUACULTURE USING POWER PLANT WASTE HEAT. Davis, L. R.; Shew, J. A.; Boersma, L. (Oregon State Univ., Corvallis). pp 9.1-9.17 of Energy, Environment, and Engineering. Stillwater, OK; Oklahoma State Univ. (1973).

From proceedings on frontiers of power technology; Stillwater, Oklahoma, USA (10 Oct 1973). See CONF-731096-.

The energy requirements for the open basins used for single cell protein production and fish farming, and the possibility of supplying this energy from waste heat, are discussed. Heating requirements for open aquaculture basins were determined for three types of climatic conditions found in Oregon. All potential means of heat loss from the basins were evaluated. The main mechanism of heat loss was the combined effects of evaporation and convection at the surface of the basin. For a 4 foot deep basin the thermal inertia would be great enough to allow the use of daily average weather data for the computation of energy requirements. For a coastal site, with once through cooling, the heated condenser discharge water was not warm enough to maintain a basin at 85°F at any time of the year. The water was warm enough to heat the 75°F basin from mid-May through October. The design heating rate for the 75°F and 85°F basins are 6,300 and 9,200 Btu/ft²-day respectively. It was concluded that raceways in which fish are grown in the condenser cooling water would be the most economical arrangement for this area. For a Willamette Valley site, using a wet cooling tower, it was found that the heated condenser discharge water was warm enough to meet the heating requirements for both the 75°F and 85°F basins throughout the year. These basins could be beneficially used to grow fish or algae with no other source of energy needed. The design heating rates for the 75°F and 85°F basins are 7,300 and 9,800 Btu/ft²-day respectively. For an Eastern Oregon site, using a cooling reservoir, it was found that the heated discharge water was warm enough to supply the needed energy for the 85°F basin from mid-April through mid-October. For the 75°F basin the discharge water was sufficient to supply the needed heating energy from mid-March through mid-November. The design heating values were 7,300 and 10,000 Btu/ft²-day for the 75°F and 85°F basins respectively. Data are included on the savings and expenses for the 75°F and 85°F basins for the three sites considered, and the cost of electricity if the auxiliary heating were accomplished with a heat pump having a C.O.P. of 3.5. (CH)

6472 PHYSICAL PROCESSES RESPONSIBLE FOR DISPERSAL OF POLLUTANTS IN THE SEA. Symposium Held in Aarhus, Denmark, July 4-7, 1972. Kullenberg, G.; Talbot, J. W. (eds.). Rapports et Proces-Verbaux des Reunions, Volume 167. Charlottenlund Slot, Denmark; Conseil International pour l'Exploration de la Mer (1974). 259p. (CONF-720718-). D. Kr. 90.00.

A separate abstract was prepared for one of the papers included. (CH)

For an abstract of an individual paper see: 6473.

6473 NUMERICAL MODEL OF THE TEMPERATURE DISTRIBUTION IN THE VICINITY OF SIZEWELL POWER STATION OUTFALL. Williams, J. M. (Hydraulics Research Station, Wallingford, Eng.). pp 171-176 of Physical Processes Responsible for Dispersal of Pollutants in the Sea. Kullenberg, G. (ed.). Charlottenlund Slot, Denmark; Conseil International pour l'Exploration de la Mer(1974).

From symposium on physical processes responsible for dispersal of pollutants in the sea with special reference to the nearshore zone; Aarhus, Denmark (4 Jul 1972).

An idealized mathematical model of the dispersion processes of power reactor thermal effluents from an outfall is described. It is shown that, despite the uncertainty in knowledge of many of the physical coefficients involved, the resultant excess temperature at the intake can be predicted within reasonable bounds. The method was used in the evaluation of the recirculation performance of Sizewell Nuclear Power Station on the east coast of England. (CH)

Chemical Effluents

Refer also to abstracts 6405, 6408, 6411-6413, 6434, 6435, 6463, 8282, 8290, and 8357.

6474 (Y-DA-6106) BIOLOGICAL DENITRIFICATION OF NITRATE WASTE SOLUTIONS. Clark, F. E.; Francke, H. C.; Strohecker, J. W. (Oak Ridge Y-12 Plant, Tenn. (USA)). 1975. Contract W-7405-eng-26. 35p. (CONF-750524-1). Dep. NTIS $4.75.

From 30th annual Purdue industrial waste conference; West Lafayette, Indiana, USA (6 May 1975).

Based on careful laboratory and pilot-plant work, the Y-12 Plant of the Nuclear Division of Union Carbide has designs to construct and operate a three-phase plant to eliminate nitrate as a potential pollutant of ground water. A still is being installed to distill and recover free nitric acid from condensates and raffinate for recycle in production operations. A crystallizer is in the process of being purchased and installed to recover and recycle $Al(NO_3)_3.9H_2O$. The 25,000-gallon (95 m³) modified water-softening tanks with associated stirring equipment, plumbing, pumps and controls have been purchased. Either one or both of these vessels will be utilized as biological denitrifiers dependent upon the quantity of nitrate requiring disposal at any given time. One denitrifier may be utilized to maintain a standby working colony or culture of bacteria and simultaneously achieve an even lower nitrate concentration in the effluent stream than the present 40 to 100 mg/dm³ of solution. (auth)

INSTRUMENTATION

Radiation Detection Instruments

Refer also to abstract 5910.

General Detectors and Monitors

Refer also to abstracts 6822, 6825, 6881, 6884, 6885, 7876, and 8367.

6475 (AD-775849) OCD-D-103: A NEW HIGH-STABILITY BETA/GAMMA GM TUBE. Final Report. Johnston, J. G. (American Cyanamid Co., Bound Brook, N. J. (USA). Chemical Research Div.). Oct 1973. Contract DAHC20-67-C-0190. 57p. NTIS $3.75.

Replacement GM tubes for the civil defense CDV-700 portable survey meter were not always compatible with every instrument even though both tube and instrument met the specification requirements. To alleviate this problem, a comprehensive specification was written for a GM tube based upon desirable features rather than demonstrated performance. The report details the engineering effort which produced a tube to meet formidable new specifications. (auth)

6476 (AD/A-001717) PRODUCTION ENGINEERING MEASURE FOR HIGH-RANGE GEIGER-MUELLER TUBE. Quarterly Report No. 2, September-November 1972. Lehnert, R. W. (LND, Inc., Oceanside, N. Y. (USA)). 1974. Contract DAAB05-72-C-5869. 56p. NTIS $4.25.

An investigation of the proper techniques employed to provide stable, predictable performance, G-M tubes for use as the high range detector of the AN/VDR-1 is discussed. The techniques include special cathode and anode surface treatment to prevent secondary emissions and resultant spurious counts (instability) and up-dated outgassing and filling procedures to improve gas stability and reduce absorption thereby improving voltage stability. In the time period of this report a second set of engineering test samples was fabricated and filled to a starting voltage range of 430 plus or minus 10 volts. Initial test data indicate a trend toward achieving the required critical parameter of starting voltage stability. (GRA)

6477 (AD/A-001718) PRODUCTION ENGINEERING MEASURE FOR HIGH-RANGE GEIGER-MUELLER TUBE. Quarterly Report No. 3, December 1972-February 1973. Lehnert, R. W. (LND, Inc., Oceanside, N. Y. (USA)). 1974. 37p. NTIS $3.75.

This program is an investigation of the proper techniques employed to provide stable, predictable performance G-M tubes for use as the high range detector of the AN/VDR-1. The techniques include special cathode and anode surface treatment to prevent secondary emissions and resultant spurious counts (instability) and up-dated outgassing and filling procedures based on the first and second group of engineering test samples to improve gas stability and reduce absorption thereby improving starting voltage stability. (GRA)

6478 (AD/A-001719) PRODUCTION ENGINEERING MEASURE FOR HIGH-RANGE GEIGER-MUELLER TUBE. Quarterly Report No. 4, March-May 1973. Lehnert, R. W. (LND, Inc., Oceanside, N. Y. (USA)). 1974. Contract DAAB05-72-C-5869. 44p. NTIS $3.75.

This program is an investigation of the proper techniques employed to provide stable, predictable performance G-M tubes for use as the high range detector of the AN/VDR-1. The third set of engineering test samples was fabricated and pumped during the fourth reporting period. Tests were begun to determine if all the parameters of the specification can be met. A study of different pumping techniques and systems was conducted to determine the best possible system to be used. (GRA)

6479 (AEEW-R-936) CALIBRATION OF FISSION CHAMBERS FOR FAST REACTOR EXPERIMENTS. Sweet, D. W. (UKAEA Reactor Group, Winfrith. Atomic Energy Establishment). Aug 1974. 47p. Dep. NTIS (US Sales Only) $5.50. UK pounds 1.00.

The preparation of a set of absolute fission chambers for the measurement of reaction rates in Zebra is described. Their calibration and the associated errors are discussed and an account of the checks made to provide confidence in their performance is given. (auth)

6480 (CEA-CONF-2727) RESULTS FROM A STUDY ON THE MAINTENANCE OF EQUIPMENTS FOR RADIATION MONITORING PANELS. Cortet, J. P.; Krakowski, D.; Meriaux, P. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Services d'Electronique). 9 Aug 1974. 35p. (In French). INIS.

From 2nd national congress on reliability; Perros-Guirec, France (17 Sep 1974).

Radiation monitoring panels are intended for monitoring nuclear plants submitted to an irradiation or an important radioactive contamination involving a grave risk for the personnel. The Merlin-Gerin Society was asked to develop the elements for a prototype of radiation monitoring panel intended to equip a laboratory at CEN-Saclay. An a-priori maintenance study relating to the first version of this prototype is presented. (auth)

6481 (CEA-N-1781) ^{58}Co COUNTING. Method for Analysis. Bouvard, P. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Services des Piles). Oct 1974. 24p. (In French). INIS.

An automatic method is presented for the analysis of counting results obtained on the 0.81-MeV peak of cobalt-58 formed by the reaction ^{58}Ni(n,p)^{58}Co. A program written in FORTRAN calculates the ^{58}Co activity, the statistical error, and the equivalent fission fluence. (FR)

6482 (COM-74-51185) STANDARD REFERENCE MATERIALS: CALIBRATED GLASS STANDARDS FOR FISSION TRACK USE. Final Report. Carpenter, B. S.; Reimer, G. M. (National Bureau of Standards, Washington, D. C. (USA)). Nov 1974. 27p. (NBS-SP-260-49). GPO.

Four glasses of different uranium concentrations were prepared and certified by the National Bureau of Standards as standards for use as neutron monitors to aid fission track studies. These standard reference materials (SRM) and their uranium concentrations are: SRM 941 (461 ppM), SRM 962 (37.4 ppM), SRM 963 (0.823 ppM), and SRM 964 (0.0721 ppM). These glass wafers were irradiated in the National Bureau of Standards reactor and the neutron flux was monitored using copper and gold foils. (GRA)

6483 (IBK-1281) PROGRAMME FOR PROCESSING THE DATA OBTAINED BY FOILS ACTIVITY MEASUREMENTS. Dimitrijevicj, Z.; Soticj, O. (Institut za Nuklearne Nauke Boris Kidric, Belgrade (Yugoslavia)). 1974. 15p. (In Serbian). INIS.

In this report, the description and user's manual of the program for processing the data obtained by foil activity measurements on the automatic sample changer at the "Boris Kidric" Institute of nuclear sciences are given. According to the input requirements of the program, certain conditions for proceeding the measurements on the sample changer must be fulfilled. These conditions, as well as the possibilities of the automatic sample changer equipment are explained. (INIS)

6484 (N-74-27877) APOLLO 17 LUNAR SURFACE COSMIC-RAY DETECTOR. Final Report. Walker, R. M. (Washington Univ., St. Louis, Mo. (USA). Lab. for Space Physics). May 1974. Contract NAS9-11895. 108p. (NASA-CR-134329). NTIS $8.50.

The objectives and selected data are presented for the Apollo 17 Lunar Surface Cosmic Ray Experiment (LSCRE) for the purpose of introducing an analysis of three of the separate detectors contained within in LSCRE package. The mica detector for measuring heavy solar wind, and the lexan stack and glass detectors for measuring energetic particles in space are discussed in terms of their deployment, exposure time, calibration, and data yield. Relevant articles on solar particles, interplanetary ions, and cosmic ray nuclei are also included. (STAR)

6485 (NIRS-R-2, pp 94-96) POSITRON CAMERA. Tomitani, T.; Tanaka, E.; Nohara, N.; Iinuma, T. Nov 1973. (In Japanese).

In first report on the cancer therapy with high energy particles and the utilization of short lived radionuclides in diagnostics. (National Inst. of Radiological Sciences, Chiba (Japan)).

In a positron camera with no collimation, its high countrate characteristic is impaired due to the increase in ineffectual counting. While the efficiency increases as the main detector is placed farther away from a source the region of uniform detection efficiency is reduced on a plane perpendicular to the depth direction. In the positron camera developed, these drawbacks were largely improved. A coarse collimator of long focusing is used with a gamma camera as a main detector. The ineffectual counting is thus reduced without lowering position resolution, and at the same time, improvement of efficiency uniformity is achieved by the slight sacrifice of detection efficiency. For the focal detector opposite to the main detector a polycrystalline position detector was newly designed and used. A high-speed logical circuit was incorporated to meet the need of high counting rate. (JA)

6486 RADIATION DETECTOR. Miyazawa, T. (to Tokyo Shibaura Electric Co. Ltd.). Japanese Patent 1973-23024/B/. 28 Mar 1968. 4p. (In Japanese).

The present invention relates to an improvement upon a radiation detector which is used to detect the spacial distribution of radioactive substances in an object. The conventional apparatus comprises a spark chamber, a camera to record the sparks which occur when radiation enters the chamber, a quench circuit, a preset circuit, and a solenoid shutter for the camera. The object to be observed is placed under the chamber above which the camera and solenoid shutter are placed. Radiation which enters the chamber causes a spark which is recorded by the camera. Simultaneously, an electric pulse occurs in the quench circuit which is placed between the high voltage supply and the chamber electrode. The present circuit generates a signal when a predetermined number of pulses have been connected. This signal is fed to the solenoid shutter to close it. Thus, the spatial distribution of the radioactive substance is recorded as a concentration of spark images on the photographic film. The present inventor has found that two kinds of sparks take place in the chamber, one associated with a large and the other with a small discharge current, the ratio of which is dependent upon the gas pressure in the chamber and the applied voltage. The sparks associated with small discharge current cause only faint traces on the background of the photographic film. In the present apparatus, a pulse-height analyzer and a discriminator circuit are added to the conventional one. The pulse-height analyzer is used to monitor the ratio of these two kinds of sparks and serves to find the optimum condition by adjusting the applied voltage, gas pressure, or time constant of the quench circuit. The discriminator circuit is used to select pulses larger than the predetermined voltage and makes it possible for the present circuit to respond only to the selected high pulses. (JA)

6487 SEMICONDUCTOR DETECTOR. Takayanagi, S.; Sugita, T.; Kobayashi, T. (to Tokyo Shibaura Electric Co. Ltd.). Japanese Patent 1973-18877/B/. 17 Feb 1969. 6p. (In Japanese).

The present invention relates to an improved radiation detector for the absolute measurement of radiation intensity emitted from radioactive substances contained in gases. This invention is intended to be used for the measurement of β-rays of ^{85}Kr in a bronchial tube to determine the ventilation capacity of a lung. The present invention consists of a P-N junction semiconductor radiation detector held at one end of a cylindrical metal sheath whose depth D is greater than five times the radius R. Thus by limiting the detectable radioactive gas to that inside the cylindrical metal sheath, the counting rate can be made independently of the size and shape of the gas container (the bronchial tube), hence absolute measurement is possible. To make the concentration of the radioactive substance inside the cylinder equal to that outside the cylinder, a space is provided between the sheath and the detector holder so that the gas flows relatively freely inside the cylinder. In another embodiment of this invention, the sheath is provided with at least one small hole to make gas flow possible. (JA)

6488 TRIAL CONSTRUCTION OF POSITRON CAMERA WITH FOCUSED COLLIMATOR. Okano, S. (Institute of Physical and Chemical Research, Wako, Saitama (Japan)); Onai, Y.; Uchida, I.; Tomaru, T.; Irifune, T. Radioisotopes (Tokyo); 23: No. 9, 505-510(Sep 1974). (In Japanese).

The positron camera presently in use has a high sensitivity, good resolution, and tomographic effect, but disadvantages of this camera, in addition to its complicated electronic circuits, are that it overloads easily and many accidental coincidences arise, because a collimator is not employed. For the purpose of improving these disadvantages, a positron camera with a focused collimator has been constructed for trial. It consists of an image detector with the Anger camera, a coincidence detector with a sodium iodide crystal of 3-inch diameter by 3-inch thickness, a focused collimator, and electronic circuits consisting of a fast coincidence circuit, a constant fraction timing single channel analyzer, and others. An effective diameter of the coincidence detector can be varied by a small collimator. When the effective diameter is 2.5 cm, the overall resolution is independent of the distance from the face of the focused collimator to the active source, and is nearly equal to the intrinsic resolution of the Anger camera. The sensitivity of the positron camera decreases to about 1/4 by attaching the focused collimator, while the counting rates in the image detector decrease to about 1/40. This gives the same effect as the 10-fold increase in sensitivity, because the positron camera will not overload even when the amount of positron emitters administered to a patient is increased about 40 times. The usefulness of this positron camera was ascertained by its use in animals and human patients. The disadvantage of this positron camera is that the field of view is very small. In order to improve this disadvantage, a focused collimator with a focal length of 150 cm has been constructed. This instrument will be used for routine clinical studies in the near future. (auth)

6489 NON-AROMATIC LIQUID SCINTILLATOR. Yamakoshi, K. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Uchusen Kenkyu; 18: No. 3, 259-266(Jan 1974). (In Japanese).

Liquid scintillators mainly composed of non-aromatic solvent have been paid attention since the early age of liquid scintillator development. In this report, the results of examination on liquid paraffin, Shellsol-71, and kerosene, easily available domestically, are described. For the liquid paraffin, the relation of naphthalene concentration to photo-output, the relation of primary solute DPO concentration to photo-output, and the deoxidation effect by inert gas bubbling, have been studied. Shellsol-71, one of the liquid of iso-paraffin family, is transparent and scentless, and has low viscosity. It is slightly inferior in the photo-output relative to naphthalene concentration. Kerosene, a fraction of petroleum having the boiling point of 150 to 250°C, presented better results under the same condition as the case of liquid paraffin. However, kerosene has some difficulty of higher volatility than liquid paraffin. An advantage of these materials is that reflector may be coated inside plastic vessels, and allows the scintillators to contact with it. Thus the most weak point of the liquid scintillators as compared with plastic scintillators has been removed. (JA)

6490 SPARK, STREAMER, PROPORTIONAL, AND DRIFT CHAMBERS. Rice-Evans, P. London; Richelieu Press (1974). 403p.

The subject is dealt with in chapters entitled: pertinent physics; historical review; narrow-gap spark chambers; measurement in sampling spark chambers; wide-gap spark chambers; streamer chambers; proportional chambers; a miscellany of chambers (wide-gap chambers, hybrid proportional/spark chamber, neon flash tubes, hybrid-expansion chambers, noble liquid chambers, spark counters, outwardly-directed avalanche chamber, stacks of transparent discharge chambers); examples of applications of chambers (particle physics, low-energy physics, cosmic rays, study of electrical discharges, applications in medicine and biology, archaeology); drift chambers. A bibliography is included. (UK)

6491 MEASUREMENT OF THE EFFICIENCY OF A Ge(Li) DETECTOR WITH RESPECT TO AN EXTENDED SOURCE. Nagy, S. (Lajos Kossuth Univ., Debrecen); Sailer, K.; Daroczy, S.; Raics, P.; Nagy, J.; German, E. Magy. Fiz. Foly.; 22: No. 4, 323-338(1974). (In Hungarian).

A 20-cm^3, coaxial GDC-T-20, trapezoidal five-sided Ge(Li) detector, manufactured by Nuclear Enterprises, was used for the determination of the relative and absolute efficiency of this type of device with respect to an extended source. The distance of the detecting crystal from the external surface of the cryostat was 10 mm; a 1.5-mm thick aluminum foil was used as the window material. The γ intensities were determined from the full-energy peaks while the background measurements were carried out by a graphic method. The analyzer corrected automatically for the dead time during the determination of the operating time. The random coincidence (pile-up) correction was measured experimentally by adding known-frequency signals to the spectrum. The total efficiency was derived from the peak-efficiency curve obtained with standard sources from the geometry-independent peak/total surface ratios. An ALGOL computer program was written for the actual calculations, and ^{226}Ra and ^{149}Nd sources were used for the high-precision determination of the relative efficiency. For obtaining absolute values, ^{203}Hg, ^{137}Cs, ^{60}Co and ^{88}Y standard point sources and an extended ^{235}U source were employed. (TTT)

6492 RADIOMETRIYA NEITRONOV AKTIVATSIONNYM METODOM. (Neutron Radiometry by Activation Analysis). Lomakin, S. S.; Petrov, V. I.; Samoilov, P. S. Moscow; Atomizdat (1975). 208p.

The book presents methods of measurement of the flux density, the transfer and spectral parameters of thermal, intermediate and fast neutrons, in which use is made of radiation (from activated products) detectors, and also of methods of treating the experimental data that are obtained. A description is given of the recommended literature and of the characteristics of activation detectors. Measurement errors are analyzed. (44 figs. 37 tables, 318 refs.) (SJR)

6493 IMPROVED CELLULOSE NITRATE FILM FOR THE DETECTION OF ALPHA PARTICLES. Lupica, S. B. (Oak Ridge National Lab., TN). Radiochem. Radioanal. Lett.; 21: No. 1-2, 31-38(14 Apr 1975).

An improved cellulose nitrate film for the detection of alpha

particles has been developed. The new film is thin, durable, reproducible, and highly sensitive to alpha particle detection. A spark counting technique was used to count these detectors. The films are cast in a dry box using tetrahydrofuran as the carrier solvent and di-octyl phthalate as the plasticizer and are cemented to plastic ring mounts. After exposure to ionizing radiation and etching in a 25% KOH solution at 40°C, the mounted film is spark counted. Backgrounds are low and response to alpha radiation is linear up to 3500 counts per minute per square centimeter of film area. Several applications including radon daughter monitoring have been proposed for this film detector. (auth)

6494 MEASURING OF SOME BETA-EMITTERS IN AQUEOUS SOLUTIONS BY MEANS OF THE MEASUREMENT OF CHERENKOV RADIATION. II. The Detection of ^{32}P. Mertl, F. Jad. Energ.; 21: No. 2, 57-65(Feb 1975). (In Czech).

The results of the measurements of ^{32}P by means of Cherenkov radiation detection in aqueous samples, in samples of various liquids, in colored solutions as well as in solutions containing wave-shifters, increasing the detection efficiency, are given. The calibration lines for ^{32}P activities of the order of 10^{-7} Ci/l^{-1} are presented as well as the values of the detection efficiency and those of the background for different counting vials. The calculated minimal measurable activity lies in the order of 10^{-10} Ci/l^{-1}. The relative detection efficiency of the measurements in various liquids is presented. The problem of the color quenching is discussed and the results of the most used methods of quench correction are given. The method of the optimal division of Cherenkov radiation spectrum for the use of the channel ratio correction method is proposed. The suitability of the use of wave-shifters added for routine measurements of ^{32}P is discussed. (auth)

6495 FORMATION OF A BARRIER JUNCTION IN SURFACE-BARRIER DETECTORS ON THE BASIS OF P-TYPE SILICON. Marinov, M. G.; Lefterov, D. P. (Inst. of Nuclear Research and Nuclear Energy, Sofia). Compt. Rend. Acad. Bulg. Sci.; 27: No. 11, 1485-1487(1974).

The effects of air and oxidizing processes on the formation of a barrier junction in surface-barrier detectors using p-type silicon and an aluminum electrode were studied. (WHK)

6496 INTRINSIC Ge FOR RADIATION DETECTORS. Vidra, M. (Inst. of Nuclear Research, Rez, Czech.). Jad. Energ.; 21: No. 3, 96-100(Mar 1975). (In Czech).

The measurement methods of impurity concentrations (Hall effect, temperature dependence of Ge resistivity, and capacity measurement by means of equipment developed in the Nuclear Research Institute specially for the purpose of preparing pure germanium) of intrinsic Ge prepared for x and gamma radiation detectors are described. In addition to the physical measurements, diodes are tested in radiation fields of ^{57}Co, ^{241}Am, and ^{60}Co. Resolutions of 1.15 keV and 2.4 keV have been measured for 122 keV and 1.33 MeV energies, respectively. The tests were carried out with a non-cooled preamplifier. (auth)

6497 RADIOISOTOPE SCANNERS. Crawley, J. C. W.; Veall, N. (to National Research Development Corp.). British Patent 1,368,821/B/. 2 Oct 1974. Filed date 24 Mar 1971. 4p.

Reference is made to scanners of the type referred to as "hybrid radioisotope scanners" (see Journ. Nucl. Med. 7:114 (1966)). In such a scanner the distribution of radioisotope tracer activity across a subject is sensed and mapped by means of a rod-like detector that has the form of an elongated scintillation crystal with a pair of photomultiplier tubes at its ends. This arrangement effects sensing along the crystal axis to represent transverse scanning, while longitudinal scanning is represented by relative movement between the detector and the subject. It is desirable that the crystal be as long as possible, but the cost of a long single crystal suitable for the purpose is high, and in the arrangement described the detector comprises a number of crystals packed along the longitudinal axis of a common housing. The arrangement is also stated to be advantageous in providing optimum detector characteristics. The required ancillary equipment is also described. The crystals are optically coupled with a paste material at their interfaces. (UK)

6498 DETERMINING THE SENSITOMETRIC AND INFORMATION CHARACTERISTICS OF PHOTO MATERIALS ON INTERACTION WITH AN ELECTRON BEAM. Kupreichik, N. P.; Predko, K. G. (Inst. of Physics, Minsk). Dokl. Akad. Nauk BSSR; 19: No. 2, 121-124(Feb 1975). (In Russian).

Experimental techniques are presented for determining the optical blackening density D of the developed photoemulsion as a function of the log of the exposure H of the incident radiation, and also for determining the picture contrast of the irradiated photoemulsion as a function of the frequency v. These characteristics are compared for light and electron registration of information on photolayer emulsions. Data are presented for the film Mikrat-200 with 10 keV electrons. 7 refs. (tr-SJR).

6499 RADIATION BEAM CONSTANCY CHECK BLOCK. Golden, R. US Patent 3,867,638. 18 Feb 1975. Filed Date 13 Nov 1972. 4p.

A check block for determining radiation beam constancy provides a predetermined mass having a cavity in which an ionization chamber with or without a void filling sleeve may be positioned in predetermined spaced relation to targets on the block. Periodic inspection of the block and the ionization chamber therein readily enables the constancy of the absorbed dose and energy of the radiation beam to be determined. (Official Gazette)

6500 INTRINSIC PLANE SENSITIVITY: STILL MOST SUITABLE FOR COMPARING MOVING AND/OR STATIONARY SCANNERS, AND REPLY BY D. A. CAUSER. Sharma, R. R. (Post-Graduate Inst. of Medical Education and Research, Chandigarh, India). Int. J. Appl. Radiat. Isotop.; 26: No. 4, 225-226 (Apr 1975).

Sharma comments on the points raised by Causer and Mallard (Int. J. Appl. Radiat. Isotop.; 25: 119 (1974)) concerning his views on intrinsic plane sensitivity (S_{ai}) being the most appropriate parameter for comparing moving and/or stationary scanners. He reiterates that the magnitude of S_{ai} for a functioning scanner, moving or stationary, is independent of the size of the scan area. In reply Causer maintains that there is little use in continuing the argument over sensitivity parameters since the users will ultimately decide on their usefulness. However for clarity the differences between the premises and results of Sharma's and the present author's work are set down. (UK)

6501 NON-DESTRUCTIVE ASSAY FOR RADIOPHARMACEUTICAL CAPSULES. Ford, L. A.; Jaffee, M. (Food and Drug Administration, Washington, DC). Int. J. Appl. Radiat. Isotop.; 26: No. 1, 21-23(Jan 1975).

A non-destructive technique using liquid-scintillation counting has been developed for the assay of diagnostic radiopharmaceutical capsules. (auth)

6502 MEASUREMENT OF RADIOACTIVE GASES IN DUCTS WITH A SIMPLE SCINTILLATION DETECTOR. Gibson, J. A. B.; Docherty, J. (United Kingdom Atomic Energy Authority, Harwell, Eng.). Health Phys.; 28: No. 4, 435-442(Apr 1975).

A two detector system employing a thin plastic phosphor has been designed to monitor radioactive inert gases in the effluent duct of a nuclear reactor or fuel processing facility. One detector with a thin window will detect β-, electron and γ-radiations while the other detector is covered with a thick absorber to remove the β- and electron radiations. Differences in counts from the two detectors ($\beta\gamma - \gamma$) are used to determine the activity passing the instrument. The instrument was calibrated with a release of ^{133}Xe and the theoretical response was in excellent agreement with the measured count from this source. Detector response is expressed in equivalent curies of mixed fission product gases (MFPG), i.e., $E\gamma = 1$ MeV, $\overline{E}_\beta = 1$ MeV per disintegration and 2×10^6 counts ($\beta\gamma - \gamma$) corresponds to 1 Ci of MFPG in a duct of diameter 0.58 m and a volume flow rate of 3 m^3 sec^{-1}. The maximum deviation of the calibration for a mixture of gases is ±30%. Normal background at the instrument was 0.24 mrad hr^{-1} which gives 1000 counts min^{-1} and thus 5×10^{-4} Ci min^{-1} will double the background rate. The limit of detection is 0.002 Ci per day or 0.01 Ci per month. The instrument has operated without faults for 12 months. (auth)

6503 COUNTING SHIELD FOR Ge(Li) DETECTOR. Thames, C. L. (Oconee Nuclear Station, Seneca, SC). Health Phys.; 28: No. 4, 479-480(Apr 1975).

The design of an annular-type lead shield for a Ge(Li) semiconductor detector, constructed from readily available materials and consisting of an annulus, top closure and base, is described. Energy spectra obtained with and without the shield are shown. Changes in the spectra are due to a reduction in the Compton continuum, reduction in interference peaks due to presence of uranium and uranium daughter-products in the concrete of the counting-room floor and walls, and reduction in the ^{40}K peak due to the presence of ^{40}K in the concrete-aggregate floors and walls. (UK)

6504 STUDY OF THE LOW ENERGY BACKGROUND OF A PHOSWICH DETECTOR. Johnson, J. R. (United Kingdom Atomic Energy Authority, Winfrith, Eng.). Health Phys.; 28: No. 4, 466-468(Apr 1975).

Two sources of background, not normally considered when phoswich detector backgrounds are being optimized, have been investigated. The first of these, the delayed emission from the photomultiplier tube, will not affect the background in the plu-

tonium energy band but would be important if lower energy photons were being measured. The second, the background due to the photomultiplier tube itself, does increase the background in the plutonium band by approximately a factor of 2. If this contribution could be eliminated, the background in the plutonium energy band would be reduced to the expected level of less than 1 count/min in the 12 to 25 keV band. (UK)

6505 MEASUREMENT TECHNIQUES AND INSTRUMENTATION. Hemingway, J. D. (Universities Research Reactor, Risley, Eng.). pp 105-196 of Radiochemistry. Maddock, A. G. (ed.). London; Butterworths (1975).

The subject is reviewed in chapters entitled: semiconductor detectors; scintillation detectors; gas counting; solid dielectric track detectors; photographic emulsions; absolute counting; source preparation; miscellaneous techniques; nucleonic instrumentation (modular systems); data processing and statistics. (UK)

6506 SOLID STATE RADIATION DETECTORS: GENERAL DESCRIPTION AND STATE OF ART AT ECIL. Raju, P. S.; Subrahamanyam, K.; Rao, M. V. K. (Semiconductors Div., Hyderabad, India). pp 219-222 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731299-P16B.

6507 NEW IONIZATION CHAMBER DEVICE FOR MEASURING ANGULAR DISTRIBUTION OF FISSION FRAGMENTS. Nadkarni, D. M.; Rama Rao, P. N.; Ajitanand, N. N.; Chaudhry, R. C.; Kapoor, S. S. (Bhaha Atomic Research Centre, Trombay, India). pp 223-226 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

6508 PERFORMANCE OF A ($\Delta E_1 - \Delta E_2 - E$) COUNTER TELESCOPIC SYSTEM. Chatterjee, M. L.; Pathak, B. P.; Gupta, M. (Saha Inst. of Nuclear Physics, Calcutta). pp 227-230 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

6509 DESIGN CONSIDERATION OF A HIGH EFFICIENCY, HIGH ENERGY DIRECTIONAL PHOTON COUNTER. Nath S.; Roy, S. N.; Roy, S. C. (Bose Inst., Calcutta). pp 234-237 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

6510 INVESTIGATIONS ON THE CONSTRUCTIONAL FEATURES FOR THE DEVELOPMENT OF A LOW ENERGY DIRECTIONAL PHOTON COUNTER. Nath, S.; Roy, S. N.; Roy, S. C. (Bose Inst., Calcutta). pp 238-241 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

6511 IMPROVED MAGNETIC DEFLECTION METHOD FOR THE STUDY OF INNER BREMSSTRAHLUNG ACCOMPANYING BETA DECAY. Sanjeeviah, H.; Puttaswamy, K. S.; Sanjeevaiah, B. (Univ., Mysore, India). pp 242-245 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

6512 VARIATION OF ESCAPE PEAK INTENSITY IN ARGON AND KRYPTON PROPORTIONAL COUNTERS. Murty, V. R. K.; Sivasankara Rao, K.; Parthasaradhi, K.; Rama Rao, J.; Lakshminarayana, V. (Andhra Univ., Waltair, India). pp 290 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

Radiation Dosimeters

Refer also to abstracts 6614, 6671, and 7898.

6513 (AERE-R-7887) ASSESSMENT OF ENERGY AS WELL AS RADIATION DOSE FROM A MULTI-ELEMENT FILM DOSEMETER. Smith, J. W. (UKAEA Research Group, Harwell. Atomic Energy Research Establishment). Jan 1975. 37p. Dep. NTIS (US Sales Only) $5.00. UK £1.00.

The evaluation of a radiation overexposure to a worker is assisted by a knowledge of the type and energy of the radiation involved. A method of estimating both photon and beta energy is described using the standard AERE/RPS film dosemeter and the normal density readings therefrom. The method has been applied to the basic data from past intercomparisons between the Radiological Protection Service, Sutton and AERE, Harwell and also the 1971 national intercomparison run by H. M. Factory Inspectorate. Results are given and discussed, e.g., on average the estimate of x-ray energy over the range 20 to 200 keV was within 18% of the energy quoted for the radiation applied. The method is incorporated in a computer program which may be used routinely to produce energy estimates together with dose estimates at an insignificant running cost (less than 0.25p per film). A complete listing of the program is given. (auth)

6514 (BNWL-B-127) HANFORD MULTIPURPOSE TL DOSIMETER FIELD TESTS AND EVALUATION. Nichols, L. L.; Endres, G. W. R.; Shipler, D. B.; Oscarson, E. E.; Crass, L. L. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Aug 1972. Contract AT(45-1)-1830. 31p. Dep. NTIS $4.75.

A new multipurpose thermoluminescent dosimeter (TLD) has been developed for Hanford to replace the currently used beta-gamma film dosimeter for personnel monitoring of radiation exposure. Implementation of this new system began in January, 1972. Before implementation, field tests were conducted to compare the multipurpose TLD with film dosimeters and exposure rate instruments that are currently used to assist in the evaluation of dose to personnel. Results of the tests are presented and discussed. (WHK)

6515 (CEA-N-1753) DOSIMETRY IN NEUTROTHERAPY: IONIZATION CHAMBERS PERFORMANCE. Herbaut, Y.; Bory, P.; Vivia, R.; Marcie, S. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Service de Protection et des Etudes d'Environnement). Oct 1974. 15p. (In French). Dep. NTIS (US Sales Only) $4.00.

For neutrotherapy operations with 14 MeV neutrons, the dosimetry of the neutron beam produced by an electrostatic generator behind the collimator must be carried out in the phantom as well as in air. For this purpose, measurements have been performed with chambers filled with ethylene. Two of these chambers are described in this report: a chamber made by "Greene" in the Christie Hospital Manchester, and a chamber of the same type modified in our laboratory. These chambers have been calibrated with ^{60}Co γ rays. The neutron sensivity has been calculated then measured with monoenergetic neutrons produced by a Van de Graaff accelerator. (auth)

6516 (DP-MS-75-49) RESPONSE OF SAVANNAH RIVER THERMOLUMINESCENT NEUTRON DOSIMETER TO MONOENERGETIC NEUTRONS. Hoy, J. E.; Hall, R. M. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.; Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Plant). 1975. Contract AT(07-2)-1. 12p. (CONF-750528-2). Dep. NTIS $4.00.

From 5th workshop on personnel neutron dosimetry; Gaithersburg, Maryland, USA (6 May 1975).

The Thermoluminescent Neutron Dosimeter (TLND) is an albedo-type detector designed to respond in a manner approximately proportional to the dose equivalent. The dosimeter was intended to be used in a normal working environment where a complete spectrum of neutron energies occur and where monoenergetic neutrons are practically nonexistent. However, knowledge of the response of dosimeters to monoenergetic neutrons can assist in understanding the observed response to continuous spectra. Experimental results for monoenergetic neutron exposures, at thermal and at energies greater than 125 keV, have been published. Theoretical responses of the TLND for individual energy points between thermal and 400 MeV have also been calculated. Both empirical and theoretical results agree for neutron energies above 1 MeV but differ by a factor of 10 at 125 keV. Calibrated monoenergetic neutron beams with energies of thermal, 2 keV, and 25 keV at the NBS reactor provided the opportunity to measure the TLND response at these energy points. The empirical and the calculated TLND responses for energies of thermal, 2 keV, and 25 keV are compared. (auth)

6517 (JAERI-M-5875) APPLICATION OF THE MULTI-DETECTOR METHOD TO NEUTRON DOSIMETRY. Ryufuku, H. (Japan Atomic Energy Research Inst., Tokyo). Oct 1974. 94p. (In Japanese). INIS.

To establish the method of neutron dosimetry by a multi-detector system, the following have been performed: theoretical study of the

fundamental principle, derivation of the data-processing method, practical application of the principle, and confirmation of the validity in various neutron fields. The general principle is first derived in an exact manner by the theory of convex set, and next the optimal data-processing method is obtained for the principle. It is applied to BF_3 proportional counters inserted in paraffin moderators of different thicknesses and fission fragment track detectors, with the derivation of methods to evaluate neutron dose equivalent, absorbed dose, average neutron energy and energy distribution. The procedure proved to be useful for the neutrons from a neutron slowing-down assembly, a heavy-water moderated reactor, a fuel reprocessing plant, a fast critical assembly and a Van de Graaff accelerator, where the usual results tend to be an under-estimate. It is also effective in beta and gamma dosimetries. (auth)

6518 (NIRS-R-2, pp 7-9) THIMBLE CALORIMETER FOR MIXED FIELD DOSIMETRY. Inada, T.; Sakata, S.; Hoshino, K. Nov 1973. (In Japanese).

In first report on the cancer therapy with high energy particles and the utilization of short lived radionuclides in diagnostics. (National Inst. of Radiological Sciences, Chiba (Japan)).

Calorimeters are generally most suitable for mixed field dosimetry such as that near a large accelerator. In thimble calorimeters, the drawbacks of conventional type calorimeters, including large size and disturbance to radiation field, are eliminated. Two calorimeters are used in a pair, one for measurement and the other as a dummy. Each one has a heat sensor at its center, for which thermistors are used suitably. In the experiment performed, absorbers are TEP (tissue-equivalent conductive plastic) or epoxy resin, and sealed in the containers of TEP. Calibration is made by the known irradiation with Co-60 γ-rays. The dosage measured in a mixed n-γ field is in good agreement with the value by other methods. In conjunction with TLD measurement, the determination of neutron dosage is also possible. (JA)

6519 (NRPB-R-30) EVALUATION OF THE FISSION TRACK METHOD AS A PERSONAL NEUTRON DOSEMETER. Bird, T. V.; Davies, B. L. (National Radiological Protection Board, Harwell (UK)). Sep 1974. 23p. Dep. NTIS (US Sales Only) $4.25. UK 50 pence.

The possibilities of the fission track method as a basis for a routine fast neutron monitoring service are evaluated. Comparison is made with existing routine neutron dosemeter services in terms of minimum detectable dose-equivalent, useful neutron energy range, fading properties and the cost of developing and running a routine service. The relative merits of various fissionable materials are listed including radioactivity and spontaneous fission rates and those of various methods of evaluation, in particular methods of manual scanning with a microscope and automatic spark counting, are discussed. The safety aspects of the routine issue of a radioactive dosemeter are considered and a design for a dosemeter is suggested. It is concluded that the problems of public and industrial relations arising from the use of a radioactive dosemeter could outweigh the slight technical and cost advantages of the method. However the method could be considered for use in establishments where tight controls are possible on the issue and use of the dosemeter. (auth)

6520 (ORO-4814-1) DEVELOPMENT AND APPLICATION OF SOME FAST NEUTRON DOSIMETRY TECHNIQUES UTILIZING PLASTIC TRACK DETECTORS FOR THERAPEUTIC AND HEALTH PHYSICS RELATED APPLICATIONS. Progress Report. Morgan, K. Z.; Sohrabi, M. (Georgia Inst. of Tech., Atlanta (USA)). 19 May 1975. Contract AT(40-1)-4814. 26p. Dep. NTIS $4.25.

The electrochemical-etch-foil technique continues to look extremely promising for neutron monitoring of personnel and applications in medicine and research. Some of the most important parameters that must be controlled are presented and discussed. (auth)

6521 EQUIPMENTS FOR EXPOSURE STANDARDS AND RADIATION MEASUREMENTS IN OSAKA BRANCH OF ETL. Nagata, S.; Omura, G. (Electrotechnical Lab., Tokyo (Japan)). Denshi Gijutsu Sogo Kenkyusho Iho; 38: No. 9, 525-536(Oct 1974). (In Japanese).

Methods for calibration of radiation dosimeters in accordance with the Measurement Law have been investigated at the Osaka Branch of Electrotechnical Laboratory. This paper introduces devices for the establishment and development of secondary standards for the exposure, and for the calibration and certification of X-and γ-ray dosimeters. There are also devices of special design constructed as the radiation sources for obtaining very low exposure rates in the soft and hard X-ray regions. In addition, an experimental system for automatic measurement of ionizing currents has been designed and manufactured. (auth)

6522 UTILIZATION OF LiF SINGLE CRYSTALS IN ELECTRON RADIATION DOSIMETRY. Baltmugur, K. K.; Gavrilov, V. V. (Inst. of Physics, Riga). Latv. PSR Zinat. Akad. Vestis, Fiz. Teh. Zinat. Ser.; No. 6, 41-44(1974). (In Russian).

A possibility of applying LiF single crystals for measuring electron radiation doses from 5×10^{14} e/cm^{-2} to 1.4×10^{16} e/cm^{-2} is considered. The absorption method for the procedure is suggested. The effect of radiation heating on the dosimetry information storage in M- and N_2-absorption bands is studied. (auth)

6523 DEVELOPMENT OF NEUTRON RADIATION METROLOGY AT REACTOR AND ACCELERATOR FACILITIES. Vasil'ev, R. D. At. Energ. (USSR); 38: No. 4, 240-244(Apr 1975). (In Russian).

Using data of the Second All-Union Conference on Neutron Radiation Metrology at Reactor and Accelerator Facilities (October 1974), the author generalizes the results of metrological investigations in the USSR during the three-year period following the First All-Union Conference on the same subject (October 1971). The following topics are considered: structure of metrological provisions at nuclear facilities; standard neutron sources (fields); standard samples of matter, counters and instruments; nuclear constants; standard methods of measuring, certification and calibration; reactor comparisons; errors and planning of experiments; and terminology. Conclusions are drawn from the results of generalization. (auth)

6524 MEASUREMENTS OF SURFACE DOSE USING BUILD-UP CURVES OBTAINED WITH AN EXTRAPOLATION CHAMBER. Manson, D. J.; Velkley, D.; Purdy, J. A.; Oliver, G. D. Jr. (Univ. of Missouri, Columbia). Radiology; 115: No. 2, 473-474(May 1975).

Surface dose was measured in an extrapolation chamber and was found to be less than previously reported. The slope of the build-up curve was less steep with the Clinac 4 than with ^{60}Co and much steeper with the Clinac 35 at 25 MV than with the betatron at the same energy. The gradient of the depth-dose curve in the build-up region is probably the best indicator of skin damage. (auth)

6525 VARIATION OF SKIN DOSE IN MAMMOGRAPHY. A Comparison of Blue X-Ray Film (Medichrome) with Conventional Black and White (Kodak Pe 4006). Stillman, J.; Palmer, K. (Hammersmith Hospital, London). Brit. J. Radiol.; 48: No. 567, 228-229(Mar 1975).

A limited survey has been undertaken to assess the possible reduction in total skin dose, during mammography, resulting from the use of Agfa-Gevaert Medichrome blue film with "Cawofin" high definition back intensifying screens in place of conventional non-screen film (Kodak PE 4006). Patients were radiographed in the standing position and the skin dose was measured with thermoluminescent dosimeters placed at two positions on one breast. The dosimeters were left in position throughout the examination of both breasts to record the total skin dose due to both incident and scattered radiation. Patients were grouped in terms of large or small breast size, and the results showed that the use of the Medichrome film with the intensifying screen reduced the average skin dose at both sites by a factor of 6. Further, the wide latitude of the blue film made the exposure less critical and facilitated the examination of both thin and thick tissue regions on the same radiograph. (UK)

6526 LOW ENERGY ELECTRON-BEAM DOSE DISTRIBUTIONS IN THIN LAYERS. McLaughlin, W. L.; Hjortenberg, P. E.; Pedersen, W. B. (Danish Atomic Energy Commission, Risoe). Int. J. Appl. Radiat. Isotop.; 26: No. 3, 95-106(Mar 1975).

Thin radiochromic dye film dosimeters, calibrated by means of calorimetry, make possible the determination of absorbed-dose distributions due to low-energy scanned electron beam penetrations in moderately thin coatings and laminar media. For electrons of a few hundred keV, calibrated dosimeters of about 30 to 60 μm thickness may be used in stacks or interleaved between layers of materials of interest and supply a sufficient number of experimental data points throughout the depth of penetration of electrons to provide a depth-dose curve. Depth doses may be resolved in various polymer layers on different backings (wood, aluminum, and iron) for scanned electron beams (E_{max} = 400 keV) having a broad energy spectrum and diffuse incidence, such as those used in radiation curing of coatings, textiles, plastics, etc. Theoretical calculations of such distributions of energy depositions are relatively difficult to achieve. (auth)

6527 FERROUS SULFATE CHEMICAL DOSIMETRY FOR FAST NEUTRON BEAMS. Lagunas-Solar, M. C. Davis, CA; Univ. of California (1974). 284p. University Microfilms Order No. 75-8345.

Thesis (Ph. D.).

The response of the Fricke chemical dosimeter has been studied for cyclotron produced fast neutron beams. The chemical absorbed dose was measured via conventional iron(III) spectrophotometry. The total fast neutron intensity for each sample was monitored through a special neutron activation technique using $^{24}_{11}$Na produced within the glass sample vials. The gamma-ray component of the radiation field produced from the $^{9}_{4}$Be(d,n)$^{10}_{5}$B nuclear reaction was measured via photographic dosimetry. At a bombarding energy of 27.5 MeV the gamma ray contribution to the total chemical absorbed dose was almost negligible. The results of the direct dosimetric measurements showed that the absorbed dose was proportional to the total neutron intensity over the range from 2.5 to 100 krads. The apparent dosimeter response was sensitive to the average neutron energy. However, the available background information was inadequate to permit a detailed theoretical analysis of the energy dependence results. The induced $^{24}_{11}$Na vs Fricke absorbed dose proportional relationships have been tested only over the sensitivity range of the present spectrophotometric procedure. However, the enhanced sensitivity of the $^{24}_{11}$Na radioassay provides an experimental basis for the estimation of small dose values from measured radioactivity data. Based upon the rather insensitive radioassay procedure used in this work, for a 10 minute sample count the minimum detectable statistically significant absorbed dose was 2.7 rads. It should be emphasized that this chemical absorbed dose via calibrated activation foil (CADCAF) technique is directly applicable only in experimental situations in which the neutron beam is not appreciably degraded by the irradiated moiety, and that further developmental work is needed. The effect of added chloride ions to the dosimeter solution was also studied for both ^{60}Co gamma-rays and fast neutron beams. A greater scavenger action toward the high LET recoil protons was observed and measured as a function of chloride ion molar concentration. Mechanisms are proposed to explain the chloride ion effect upon the standard dosimeter response. (Diss. Abstr. Int., B)

6528 BACK-SCATTER AND BUILDING-UP EFFECTS ON THE THERMOLUMINESCENCE SENSITIVITY OF A THERMAL NEUTRON MONITOR. Nakajima, T.; Totti, V.; Watanabe, S.; Fujimoto, K.; Maung, S.; Nishimura, A. (Instituto de Energia Atomica, Sao Paulo, Brazil). Int. J. Appl. Radiat. Isotop.; 26: No. 4, 153-158(Apr 1975).

The thermal neutron monitoring system used with ordinary thermoluminescence dosimeters has been studied. In this monitoring system, the capture γ-rays from the reaction between cadmium and thermal neutrons were used. The effects of the back-scatter and building-up of radiation have been studied for n/γ ratio values of the system approaching that of the mixed field. It has been found that the ratio of a system using these effects is greater than that of one without these effects, and that the minimum measurable fluence is about 10^6 n/cm^2. This method can be used for all kinds of thermoluminescence dosimeter phosphors. (auth)

6529 INTERCOMPARISON IN-PILE DOSIMETRY IN GRR-1-CALORIMETERS AND CHEMICAL DOSIMETERS: CYCLOHEXANE AND DICARBOXYLIC ACIDS. Radak, B. B. (Institut za Nuklearne Nauke Boris Kidric, Belgrade); Gal, O. S.; Marketos, D. G.; Boyd, A. W. Int. J. Appl. Radiat. Isotop.; 26: No. 1, 43-44 (Jan 1975).

In this note brief details are given of a study undertaken to clarify discrepancies in the results in intercomparison experiments already reported of in-pile dosimetry using calorimeters and chemical dosimeters. Full details are reported elsewhere (Radak et al, Greek Atomic Energy Commission, Nuclear Research Centre "Democritos", Rept. DEMO 74/8 (1974)). The chemical systems were cyclohexane, oxalic acid solid and in aqueous solution and solid succinic acid which were irradiated in the same positions as the calorimeters. The calorimetric values were taken as standards for the evaluation of the absorbed dose in the dosimeters. Results are tabulated from which it can be seen that cyclohexane showed an unexpected discrepancy of 20% while oxalic acid both as solid and solution showed good agreement unlike previous comparisons. Succinic acid showed high values as compared to calorimetry both in this work and previously. (UK)

6530 PASSIVE ENVIRONMENTAL NEUTRON DOSIMETER. Apt, K. E.; Schiager, K. J. (Los Alamos Scientific Lab., NM). Health Phys.; 28: No. 4, 474-476(Apr 1975).

A low-level total-neutron dosimeter employing a 0.25-m-diameter spherical polyethylene neutron moderator incorporating fission-fragment track registry assemblies, is described. As an environmental neutron dosimeter this equipment is cheap, rugged, sensitive and passive and coupled with existing thermoluminescent dosimetry systems provides a very desirable technique for measuring environmental levels of electromagnetic and neutron radiation. (UK)

6531 TLD WITH TERBIUM-ACTIVATED MAGNESIUM ORTHOSILICATE. Jun, J. S.; Becker, K. (Oak Ridge National Lab., TN). Health Phys.; 28: No. 4, 459-461(Apr 1975).

Some of the interesting dosimetric characteristics of Mg_2SiO_4: Tb ($2MgO \cdot SiO_2$ activated with ~0.001 g-atom/mol Tb^{3+}) are reported. It was found that the material combines a very high sensitivity, the simple annealing characteristics and excellent fading stability of phosphors such as $CaSO_4$: Dy and CaF_2: Mn with a lower dependence of response on the photon energy. Its uv response characteristics are complex but this does not pose a problem if the phosphor is protected from intense light. (UK)

6532 INVESTIGATION OF A COMPOSITE NEUTRON ACTIVATION DOSIMETER. Agnew, J. F.; Landolt, R. P.; Kessler, W. V.; Ziemer, P. L. (Purdue Univ., Lafayette, IN). Health Phys.; 28: No. 4, 429-434(Apr 1975).

The feasibility of a neutron dosimeter containing several neutron activation detectors incorporated into a single composite was studied. The elements investigated in the composites were Au, Mn, Na, In, Cu, W, Co and Mo. It was found that the values of the neutron spectrum characterization parameters placed these elements into four groups and that certain pairing combinations gave better results than others. The activities of the neutron-induced radioactive products were measured with a Ge(Li) γ ray spectrometer. Analysis of the γ ray spectral data leading to calculations of the neutron fluence rate and dose equivalent was performed by computer. Potential applications include interstitial or intracavitary dosimetry for neutron radiotherapy, dosimetry of neutrons produced by neutron generators, and use in criticality dosimeters. (auth)

6533 ENERGY DEPENDENCE OF FOUR NEUTRON REMMETER INSTRUMENTS. Hankins, D. E.; Cortez, J. R. (Los Alamos Scientific Lab., NM). Health Phys.; 28: No. 3, 305-307 (Mar 1975).

A comparison of the response of four portable neutron remmeters, the 9 in. sphere, the 10 in. sphere, Snoopy and Studsvik, to neutron energies from thermal to 14.9 MeV is reported. The relative response of the four neutron monitors is shown as a function of neutron energy and also plotted is the inverse of the dose curve taken from NCRP Report No. 38 (1971). The monitors were designed to have a response to fast neutrons that approximates the dose curve, and it is shown that this was reasonably successful out to ~7.0 MeV, where the response drops rapidly. (UK)

Nuclear Spectroscopic Instrumentation

6534 (AD/A-002325) DATA PROCESSING OF SPHERICAL ELECTROSTATIC ANALYZER (SEA) EXPERIMENTS FLOWN ON INJUN-V AND ISIS-I SATELLITES. Final Report, 1 April-30 November 1973. Delaney, J. R. (Interstate Electronics Corp., Anaheim, Calif. (USA)). 15 Mar 1974. Contract F19628-73-C-0215. 22p. (AFCRL-TR-74-0132). NTIS $3.25.

The program modifications implemented to complete the standard data processing of the Injun-V and Isis-I spherical electrostatic analyzer (SEA) experiments are described. Also included are production statistics and a summary of problem acquisitions which could not be processed. Approximately 2,000 digitized data tapes were processed. (GRA)

6535 (ANL/NDM-12) SPECTROMETER FOR THE INVESTIGATION OF GAMMA RADIATION PRODUCED BY NEUTRON-INDUCED REACTIONS. Smith, D. L. (Argonne National Lab., Ill. (USA)). Apr 1975. Contract W-31-109-Eng-38. 49p. Dep. NTIS $5.50.

A spectrometer for measurement of cross sections for gamma-ray production by neutron-induced reactions has been constructed for use at the Argonne National Laboratory Tandem Dynamitron Accelerator Facility. Gamma radiation is detected by a shielded Ge(Li) detector in the angular range 30 to 135°. Neutron fluence is monitored with either a fission detector or a plastic scintillation detector. Raw data are recorded with an on-line digital computer and these data are subsequently reduced to cross sections by off-line processing. The characteristics of this facility and general features of the data processing are described herein. (auth)

6536 (CEA-CONF-2794) USES OF Si(Li) SPECTROMETERS WITH AN ENERGY DISPERSION. Friant, A. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Services d'Electronique). 11 Oct 1974. 32p. (In French). INIS.

From one-day meeting on nuclear detectors; Grenoble, France (17 Oct 1974).

The present-day performance of energy dispersing spectrometers is reviewed. Their use in elementary nondestructive analysis

and their applications in different branches of research are mentioned. Progress during the last two years concerns the spectrometer as a whole: miniaturization, background, associated electronics and minicomputer spectrum processing. The general diagram of an elementary analysis unit based on x-ray excitation of the elements of a sample is given. These spectrometers also serve for the study of decay schemes in fission produce metrology and fission x-ray studies and in muon, pion and kaon x-ray spectrometry. (auth)

6537 (GSI-P-2-74) CONCEPTUAL DESIGN OF A MANY-PARTICLE COINCIDENCE SPECTROMETER WITH LARGE-AREA GAS DETECTORS FOR EXPERIMENTS AT GSI. Albrecht, R.; Grosse, E.; Martin, B.; Sann, H.; Wiemers, M.; Wurm, J. P.; Gemmeke, H.; von Harrach, D.; Pelte, D.; Povh, B. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (F. R. Germany)). Sep 1974. 30p. (In German). INIS.

The specifications to be met by the heavy ion beam and the measuring equipment are precisely examined using the example of $^{238}U + ^{238}U$. The conclusions on the design of the detectors, the vacuum chamber, the beam quality and beam guidance are discussed. (GE)

6538 (JINR-P11-8633) CONTROLLER IN THE CAMAC SYSTEM FOR TWO-DIMENSIONAL SPECTROMETER MEASUREMENTS AND FOR CONNECTION WITH MEMORY 4K. Zimin, G. N.; Pavlenko, V. V. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 6p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The logic scheme of a controller in the CAMAC system, intended for one- and two-dimensional spectrometric measurements and for connection with memory of 4K volume, is described. (auth)

6539 (N-74-33976, pp 37-43) SOME CHARACTERISTIC FEATURES OF THE CONSTRUCTION OF THE AMPLIFYING CHANNEL FOR WORKING WITH SEMICONDUCTOR DETECTORS IN THE CHARGED PARTICLE ENERGY SPECTROMETER. Kuzyuta, E. I. Sep 1974. Translated from pp vp of Tekhnologiya Proizvodstva Kosmicheskoy Apparatury, Nauka Press, Moscow, 1974.

In technology for the production of space equipment.

A study was made of a transistorized spectrometric amplifier with a shaper to select the shape of the frequency characteristic of the amplifying channel for which the primary frequency spectrum of the signal will pass, but the noise spectrum is limited to the maximum. A procedure is presented for selecting the shaping circuits and their inclusion principle. (auth)

6540 (RD/B/N-3222) LOW BACKGROUND BETA SPECTROMETER; DESIGN AND PRELIMINARY RESULTS. Payne, J. F. B. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Oct 1974. 16p. Dep. NTIS (US Sales Only) $4.00.

A low background β spectrometer has been constructed with the object of measuring low levels of radioactive isotopes which emit β particles only, e.g., ^{90}Sr. The background count rate of the spectrometer is 6×10^{-2} counts s^{-1} in the range 0.1 to 2.3 MeV and 3.5×10^{-2} counts s^{-1} in the range 1.5 to 2.3 MeV. The spectrometer is easily capable of measuring an activity as low as 5 pCi of strontium-90. (auth)

6541 X-RAY SPECTROMETER. Tsuruoka, M.; Tanoue, T. (to Tokyo Shibaura Electric Co. Ltd.). Japanese Patent 1973-23029/B/. 30 Aug 1968. 5p. (In Japanese).

This invention aims to provide an x-ray spectrometer at reasonable cost which is capable of indicating and processing the analysed data as digital representation. The main part of the x-ray diffraction apparatus consists of an intermittent x-ray apparatus of a charged capacitor, a goniometer and a scaler with a counter. A capacitor is charged by rectifying the voltage of a high voltage transformer. The charging voltage is regulated by an x-ray tube with a control lattice. A circuit allows the charging to stop when the charging voltage reaches a definite value. Another circuit allows the capacitor voltage to reach a definite value for discharge by signaling the control lattice. The goniometer is intermittently driven in relation to a definite amount of x-rays intermittently irradiated from the x-ray tube. A device is designed to count the x-rays diffracted by the goniometer, obtaining the output as a digital value of diffraction intensity at every intermittent positioning of the goniometer. The present apparatus free from individual differences in reading allows data processing to be done rapidly by means of a computer. When the x-ray intensity is required, no timer is necessary. The x-ray apparatus free from voltage at the power source necessitates no tube voltage or tube current stabilizer, stabilizing the output of the x-rays irradiated. Thus the x-ray signal pattern is high in accuracy and the analysis based thereupon is accurate. (auth)

6542 A PEAK STABILIZER USING A DIGITAL INTEGRATOR. Uehara, S.; Seo, T.; Nakano, Y.; Hayashi, T. (Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst.). Annu. Rep. Res. Reactor Inst., Kyoto Univ.; 7: 10-19(Oct 1974).

A peak stabilizer system whose stabilizing factor can be made infinity by the use of a digital integrator is presented. The use of a voltage-controlled-gain amplifier has made the stabilizing system simple. The characteristics of the feedback system are described in comparison with theoretical calculations. The results of the test measurements are in agreement with the theoretical analysis. The system works well even at a low counting rate of 5 cps owing to its infinitely large stabilizing factor. (auth)

6543 STATISTICAL APPROACH TO THE CHOICE OF CHANNEL-WIDTH IN GAMMA-RAY SPECTROMETRY. II. The Use of a Semi-Empirical Relation Between Resolution and Gamma-Ray Energy for NaI(Tl) Scintillation Detectors. Furler, R. (Univ. of Amsterdam). J. Radioanal. Chem.; 24: No. 2, 411-421(1975).

Equations giving the percentage of extra peak-broadening caused by the finite channel-width in multichannel gamma-ray spectrometry were earlier developed by means of a statistical treatment. Empirical straight-line fits were used for the energy vs. resolution curves. In this paper this treatment is applied, but using instead a semi-empirical second-order equation for NaI(Tl) detectors. The disadvantage of the use of two equations to describe one detector is thus overcome. Four different ways to estimate the extra peak-broadening as a function of channel-width, depending on the degree of precision required, are presented. A statistical consideration giving the precision of each estimate is included. It appears that for many cases no specific detector information is required. For these cases a generally applicable plot is given. (auth)

6544 DIRECT MEASUREMENT OF ISOTOPE ACTIVITY IN CYCLOTRON TARGETS. Panarin, M. V.; Krasnov, N. N.; Dmitryev, P. P. (Physical-Energy Inst., Obninsk, USSR). Isotopenpraxis; 10: No. 11-12, 428-431(1974). (In German).

A method for the direct measurement of the γ activity of radionuclides is described. A special measurement installation is used so that measurements of targets of varying geometries can be made with scintillation detectors. Three types of targets were used: cap-shaped, disc-shaped, and cassettes. The activity measured was compared with standard sources and corrected for the efficiency of the photoregistration and for the geometry of the source. As examples activity measurements of nuclides of all three types of cyclotron targets were described. The targets discussed were ^{56}Co, ^{48}V, and ^{85}Sr. (JSR)

6545 CONSTRUCTION OF THE ELECTRON CONDUCTOR SPECTROMETER SULEIKA AND MEASURING OF THE $^{123}Te(n,e^-)^{124}Te$ CONVERSION ELECTRON SPECTRUM. Osterman, P. Frankfurt am Main; Univ. Frankfurt am Main (1973). 76p. (In German). INIS.

Thesis.

Construction and properties of a superconducting conversion electron spectrometer are described. This spectrometer is designed especially to measure conversion electrons after neutron capture. The conversion electron spectrum of the $^{123}Te(n,e^-)^{124}Te$ capture is analyzed between 80 keV and 3 MeV. Spin and parity of several of the energy levels are determined. (GE)

6546 12-CHANNEL MAGNETIC BETA-RAY SPECTROMETER FOR QUICK MEASUREMENTS. Fukushima, S. (Osaka Univ.); Mito, A.; Morikawa, K. Int. J. Appl. Radiat. Isotop.; 26: No. 1, 37-40(Jan 1975).

A multichannel magnetic spectrometer, which has proved to be convenient and powerful for quick electron measurements, is described. It employs 12 small GM-counters installed at intervals along the focal plane. Due to the finite size of the counters and the buffle boards and exit slits necessary for each electron channel to eliminate stray electrons and improve resolution, certain "shaded areas" exist within which electrons are not counted. However it is shown that this multi-interval, discontinuous measurement gives sufficient information to enable one to estimate the full spectrum shape. (UK)

6547 TIME-OF-FLIGHT NEUTRON SPECTROMETRY BY AN INTERCORRELATION METHOD USING AN ACCELERATOR AS A NEUTRON SOURCE. Descroix, E.; Billerey, R.; Depraz, J. (Lyon-1 Univ., 69-Villeurbanne (France). Inst. de Physique Nucleaire); Rotival, M.; Duquesne, H.; Schmitt, A. P. (CEA Centre d'Etudes Nucleaires de Cadarache, 13-Saint-Paul-les-Durance (France). Dept. des Reacteurs a Neutrons Rapides). Rev. Phys. Appl.; 9: No. 5, 939-945(Sep 1974). (In French).

The intercorrelation method is applied to time-of-flight neutron spectrometry, neutrons being produced by a 400 keV accelerator. Its domain of validity is determined and compared with that of the

classical method. Two neutron spectra of very different kinds are measured as a test experiment: the first one is a monotonic transmission spectrum through a Li-glass, the other is a spectrum of elastic scattering from W. (FR)

6548 RESPONSE OF MOXON-RAE TYPE GAMMA DETECTORS FOR NEUTRON CAPTURE CROSS SECTION MEASUREMENTS. Iyengar, K. V. K.; Lal, B.; Jhingan, M. L. (Tata Inst. of Fundamental Research, Bombay). pp 231-233 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

High Energy Physics Instrumentation

Refer also to abstracts 7501 and 7765.

6549 (BNL-19232) ON-LINE SATELLITE/CENTRAL COMPUTER FACILITY OF THE MULTIPARTICLE ARGO SPECTROMETER SYSTEM. Anderson, E. W.; Fisher, G. P.; Hien, N. C.; Larson, G. P.; Thorndike, A. M.; Turkot, F.; von Lindern, L.; Clifford, T. S.; Ficenec, J. R.; Trower, W. P. (Brookhaven National Lab., Upton, N. Y. (USA); Virginia Polytechnic Inst. and State Univ., Blacksburg (USA)). Sep 1974. 18p. (CONF-730470-3). Dep. NTIS $4.00.

From meeting on the American Physical Society; Washington, District of Columbia, USA (23 Apr 1973).

An on-line satellite/central computer facility has been developed at Brookhaven National Laboratory as part of the Multiparticle Argo Spectrometer System (MASS). This facility consisting of a PDP-9 and a CDC-6600, has been successfully used in study of proton-proton interactions at 28.5 GeV/c. (auth)

6550 (BNL-19674) PRINTED LOW VELOCITY DELAY LINES FOR CATHODE READOUT OF PROPORTIONAL CHAMBERS. Bosshard, R.; Chase, R. L.; Fischer, J.; Radeka, W. (Brookhaven National Lab., Upton, N. Y. (USA)). 1974. 6p. (CONF-750521-1). Dep. NTIS $4.00.

From ISPRA symposium; Stresa, Italy (20 May 1975).

A readout which simultaneously insures a correct electric field, a satisfactory induced signal, the delay function itself and low particle scattering is described for multiwire proportional chambers. (WHK)

6551 (CRN/HE-74-16) STUDY FOR VERY HIGH ENERGY GAMMA RAY DETECTORS. Development of Programs to Optimize the Characteristics of the Different Elements. Steinmetz, L. (Centre National de la Recherche Scientifique, 67 - Strasbourg (France). Centre de Recherches Nucleaires; Strasbourg-1 Univ., 67 (France)). 1974. 107p. (In French). INIS.

In order to calculate any type of electron or photon detector [homogeneous (as lead glass detectors) or inhomogeneous (as scintillator sandwiches or liquid argon detectors)], programs have been developed which study the development of an electromagnetic shower initiated by a high energy (1 to 50 GeV) electron or photon. The general scheme of the program is described. The calculations of the cross sections for the various processes are explained, and the results which can be obtained from this program are discussed. (FR)

6552 (IS-M-30) NAL 30-INCH BUBBLE CHAMBER-WIDE GAP SPARK CHAMBER HYBRID SYSTEM. Anderson, E. W.; Crawley, H. B.; Kernan, W. J.; Ogino, F. (Argonne National Lab., Ill. (USA); Iowa State Univ. of Science and Technology, Ames (USA); Maryland Univ., College Park (USA); Michigan State Univ., East Lansing (USA); National Accelerator Lab., Batavia, Ill. (USA)). [nd]. 24p. (CONF-740713-39). Dep. NTIS $4.25.

From 17th international conference on high-energy physics; London, UK (1 Jul 1974).

The physical characteristics of the Experiment 2B hybrid spectrometer now operating at NAL, consisting of the 30-inch bubble chamber and four wide-gap optical spark chambers, are described. Details of the equipment and operating conditions are presented. Further details of track reconstruction and bubble chamber/spark chamber hookup software are presented, along with results for 15 to 300 GeV/c tracks. The detection of multi-gamma-ray events (up to six gamma-rays) is discussed. (auth)

6553 (JINR-P13-8668) SYSTEM OF MAGNETOSTRICTIVE SPARK CHAMBERS IN THE EXPERIMENTAL INSTALLATION "PHOTON". Zanevskii, Yu. V.; Ivanov, A. B.; Ivanchenko, I. M. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 27p. (In Russian). Dep. NTIS (US Sales Only) $4.50.

The main elements of a system of magnetostrictive spark chambers in the installation "Photon" are described and their operating properties are presented. The system operates on-line with a computer and consists of: 32 two-coordinate magnetostrictive spark chambers; readout electronics; HV power supply of the chambers; a gas system of the chambers; and a complex of "on-line" programs. The installation has been constructed at the Laboratory of High Energies of JINR. (auth)

6554 (RL-75-015) 12 FT ARGONNE BUBBLE CHAMBER TST PROJECT. First Operational Test (Guidelines). Fitzharris, E. W. (Science Research Council, Chilton (UK). Rutherford Lab.). Jan 1975. 14p. Dep. NTIS (US Sales Only) $4.00.

Early in 1975 it is expected that the first fully operational test of a hydrogen filled track sensitive target surrounded by a neon-hydrogen mixture will take place in the 12 foot bubble chamber at the Argonne National Laboratory. This report is a summary of previous reports based on experience gained during tests and test operation at the Argonne and Rutherford Laboratories respectively, and is intended to provide some basic guidelines for the above test. (auth)

6555 SUPERCONDUCTIVITY AND ITS USE IN ELECTROTECHNOLOGY. Schaetti, N. (Brown Boveri and Cie, Mannheim, Ger.). BBC-Nachr.; 55: No. 8-9, 227-236(1973). (In German).

Present day magnets for spark and bubble chambers, with field strengths of around 18 to 35 kG, are the result of research and development. One of the first large, superconducting, hollow-conductor magnets was built by the BBC Oerlikon Works for the Omega spark chamber. The future prospects are discussed. (Elec. Electron. Abstr.)

6556 SURVEY OF INSTRUMENTATION AND ITS DEVELOPMENT. Brisson, J. C.; Comby, G. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Dept. de Physique des Particules Elementaires). Bull. Inf. Sci. Tech. (Paris); No. 198, 95-116(Dec 1974). (In French).

Two main experimental technics used in High Energy Physics are reviewed. The description of Mirabelle illustrates the evolution towards large bubble chambers. Particular construction of electronic device components are mentioned in the field of magnetism, polarized targets, fast detectors, multiwire chambers, fast electronics, data processing in real time. (FR)

6557 MEANS FOR SCANNING AND INFORMATION PROCESSING AT D.PH.P.E. Baton, J. P.; Feltesse, J.; Goldwasser, M.; Prevost, J.; Renardy, J. F.; Revel, D. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Dept. de Physique des Particules Elementaires). Bull. Inf. Sci. Tech. (Paris); No. 198, 117-135(Dec 1974). (In French).

Three generations of measuring devices for bubble chamber and spark chamber pictures are reviewed: the manual tables, the automatic and semi-automatic machines H.P.D., ARIANE, L.S.D. and finally the conversational machine C.R.T. Also the display terminals which visualize the data from magnetic tapes are described. A brief summary of the main technical characteristics of these equipments is given. An outline of the software used to prepare the physics analysis is given. (FR)

6558 BIG SPECTROMETERS. Borgeaud, P.; Muller, A. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Dept. de Physique des Particules Elementaires). Bull. Inf. Sci. Tech. (Paris); No. 198, 63-77(Dec 1974). (In French).

The three big spectrometers in which the Saclay Elementary Particle Department is involved are briefly described: Goliath, which already performed two experiments in the GeV range will be modified into a more general spectrometer in order to be installed at the SPS; the Omega spectrometer which is now working in the 10 GeV range will be adapted to experiments for incident beams between 20 and 60 GeV; and a spectrometer, still under study, designated to the SPS North Area in order to do experiments with several hundred GeV incident particles. As an example a more detailed description of the experiments performed at Saturne with Goliath is given. (FR)

6559 WELDING OF HYDROGEN BUBBLE CHAMBERS AND NOTCHED BAR IMPACT TESTING UNDER STREAMING LIQUID HYDROGEN AT 20 K. Farnbacher, L. Berlin; Technische Univ. (1973). 144p. (In German). INIS.

Thesis.

316 L/S 4 was chosen as working material. It was welded in such a manner by means of arc welding with the 190 L electrode that the delta-ferrite remained below 0.1% and the notch impact strength reached more than 5 kpm/cm^2 at 20 K (Charpy-V test). Welding and notch impact testing for the ever-repeating pressure drops of exposed chambers are described in detail. (GE)

6560 TECHNICAL REVOLUTION IN PARTICLE PHYSICS II. Kiss, D. (Kozponti Fizikai Kutato Intezet, Budapest). Fiz. Szemle; 24: No. 3, 77-84(Mar 1974). (In Hungarian).

The perfect detector which could detect the nature, mass, charge,

pulse and the internal quantum number of all emitted particles does not exist yet. Most of the currently used detectors have their origins in instruments used during the heroic age of particle or cosmic ray research. The available detector types are tabulated, indicating the interaction on which they are based, their sensitivity, dead time and their (space, time or energy) resolution. Counter (electronic) and track type detectors are also discussed. Among the latter—disregarding the Wilson chambers which are of historical interest only—the bubble chambers are of special importance. They include the Gargamelle chamber at CERN, the Big European Bubble Chamber at the same laboratory, the French Mirabelle chamber and the SKAT chamber at Serpukhov. Applied track detectors include the spark chamber, streamer chamber, drift chamber, etc. The electronic chambers have a much higher resolution. Detectors based on the newly examined transition radiation are currently being developed. Evaluation of the results is facilitated by the widespread use of on-line computers. There is strong cooperation between the major countries; the US and USSR participate in information exchange activities. Hungary collaborates in the work of international laboratories, such as JINR in Dubna and CERN in Geneva. (TTT)

Radiometric Instruments

6561 DETECTOR USED IN A BACK-SCATTERING TYPE RADIOMETRIC THICKNESS GAUGE. Kido, Hiroshi; Saito, S.; Kimoto, T. (to Tokyo Shibaura Electric Co. Ltd.). Japanese Patent 1973-21574/B/. 28 Dec 1968. 3p. (In Japanese).

The present invention relates to improvements upon the detector used in a reflection type radiometric thickness gauge utilized in making highly sensitive and stable measurements of a plating thickness. The present apparatus consists of a cylindrical container of radioactive material, two cylindrical anodes of different radii placed coaxially around said holder, and a cylindrical cathode made of a wire network placed between the two anodes. Thus, the two anodes and cathode compose an ionization chamber filled with argon gas. The apparatus operates as follows: The radioactive substance placed at the center of the apparatus radiates in the axial direction. A sample placed in front of the apparatus reflects the radiation back into the ionization chamber. The electric current between the electrodes indicates the intensity of the reflected radiation which is a function of the plating layer thickness. The chief advantages of the present configuration are: since the electric field in the ionization chamber can be made homogeneous, the operation is very insensitive to fluctuations in the supply voltage; the large detecting area provides a very high sensitivity; and the measurement depends less on the distance between the gauge and the sampling since the detector area is very large. (JA)

6562 RADIOIZOTOPNYE RELEINYE PRIBORY. Metodika Ispytaniya Printsipy Postroeniya. (Radioisotope Feedback Devices. Testing Methods and Theory of Construction Principles). Pozdnikov, V. N.; Polkovnikov, V. K.; Taksar, I. M.; Yanushkovskii, V. A. Moscow; Atomizdat (1974). 144p.

This book considers radioisotope feedback devices widely used for the automatic control of technical parameters in industry. A description is given of fluctuations in the electric circuits of the devices, the basic radiometric characteristics of the devices, and their relation with the electric parameters of the circuit in the instrument. A presentation is given of the methods and equipment used to control the radiometric and electric parameters of radioisotope feedback devices. The theory of circuit construction and arrangement of units in the device are considered, and a description is given of the basic parameters of the system for various categories of industrial use. Techniques and nomograms are presented for optimal selection of the basic, functional units of the system. Examples of cost-benefit analysis are given for practical use of these devices. (SJR).

6563 DOSIMETRICAL ASPECTS OF THICK LAYERS MEASUREMENT BY MEANS OF BROAD BEAM GAMMA ATTENUATION. Seda, J.; Mustiek, L. Jad. Energ.; 21: No. 2, 65-69 (Feb 1975). (In Czech).

The application of ionizing gamma radiation for the measurement of thick layers was studied from the point of view of dosimetry. The distribution of exposure rate was examined in the space around the radionuclide device with the ^{137}Cs radiation source. The results are supplemented by the measured energy spectra of the radiation in various points of the space. (auth)

6564 SYSTEM FOR SIMULTANEOUS MEASUREMENT OF ARTERIAL AND VENOUS CONCENTRATIONS OF RADIOACTIVE SUBSTANCES. Fischer, H. W.; Rothfield, N. J. H. (Wayne County General Hospital, Ann Arbor, MI). Med. Res. Eng.; 11: No. 4, 24-26(1972).

An apparatus to assess characteristics of renal excretion of radiographic contrast materials is described. It will allow simultaneous continuous measurement of a concentration of radioactive substances in arterial and venous blood with minimal disturbance of the subject. Thus far it has been used to measure renal arterial and venous blood valves for radioactive labeled urographic contrast media in the anesthetized dog. (HLW)

6565 COMPREHENSIVE STUDY OF IONIZATION GAUGES USING RADIOACTIVE ISOTOPES. Berman, A. (Israel Atomic Energy Commission, Yavne). Vacuum; 25: No. 2, 51-56(Feb 1975).

A study of the available literature on ionization gauges using radioisotopes has been carried out, to determine their major design criteria. Three topics are examined in detail: (1) isotopes used as ionizing source, (2) principles involved in designing the sensing head and its associated electronic circuit, and (3) sensing head construction. Special attention is given to phenomena limiting response accuracy. Advantages and shortcomings of these gauges are pointed out and their special applications are discussed. (auth)

6566 DETERMINATION OF COEFFICIENT OF MASS TRANSFER IN POROUS BODIES BY ABSORPTION OF X-RAYS AND GAMMA RAYS. Daddi, L.; Latrofa, E.; Chiappa, G. (Pisa Univ., Italy). Int. J. Appl. Radiat. Isotop.; 26: No. 4, 201-205 (Apr 1975).

This paper describes a method for the mass transfer coefficient evaluation of porous bodies by utilizing x-rays or γ rays absorption measurements for the determination of the moisture gradient. This technique is suitable for steady mass transfer conditions and for transient phases. (auth)

6567 RADIOACTIVE MEANS FOR MEASURING DISTANCE INTERVALS BETWEEN ANOMALIES IN AN EARTH FORMATION. Sandier, G.; Nels, J. P. (to Schlumberger Technology Corp.). US Patent 3,869,607. 4 Mar 1975. Priority Date 13 Jul 1972, France. 22p.

In earth formation measurements an investigating tool having a first and a second detector at a relatively small spacing from each other and a third detector at a relatively great spacing from the first and second detectors is moved through a borehole having anomalies such as radioactive bullets or casing joints which are relatively uniformly spaced from each other by a distance which is of the order of said great spacing between the third detector and the first and the second detectors. The first and second detectors generate detection signal peaks for the same anomaly within a short time interval, and the third detector generates a detection signal peak for an adjacent anomaly at about the same time. By means of a defined apparatus, electrical signals representing the times of occurrence of the detection signal peaks from the first and second detectors for the same anomaly and the known small spacing between these detectors are used to obtain an electrical signal for the speed of the investigating tool at that time, and at least some of these electrical signals are combined with electrical signals representing the time of occurrence of the detection signal peak from the third detector for an adjacent anomaly and at least one of the known distances between the detectors to thereby obtain an accurate measure of the distance interval between the pair of adjacent anomalies. (Official Gazette)

6568 NUCLEAR WELL LOGGING. Scherbatskoy, S. A. US Patent 3,869,608. 4 Mar 1975. Filed date 1 Jul 1953. 28p.

This invention comprises apparatus for detecting the compositions of materials, and specifically for logging oil well bores. The apparatus comprises a neutron generator; a scintillation crystal responsive to gamma rays, slow neutrons and fast neutrons; and a photocell responsive to the scintillations of the crystal. Means are provided for amplifying, detecting, and recording the action of the photocell to provide recorded traces of the gamma rays, and slow and fast neutrons. Means are provided for calibrating the instrument from the ground surface. (Official Gazette)

Radiation Effects on Instrument Components, Instruments, or Electronic Systems

Refer also to abstract 7213.

6569 (AD-787599) RELIABILITY TESTING OF ELECTRON BOMBARDED SEMICONDUCTOR DIODES. Smith, D. H. (Wat-

kins-Johnson Co., Palo Alto, Calif. (USA)). 20 Aug 1974. Contract N00014-72-C-0204. 46p. (W-J-74-4097C1). NTIS $3.75.

Reliability tests of reverse biased semiconductor diodes operating in electron bombarded semiconductor devices are described. One Class B device operating at 20 W/sq mm power dissipation density has been tested in excess of 10,000 hours. Another similar device is approaching 10,000 hours of operation. No degradation in performance characteristics has been observed in either device. The diodes used in these devices incorporate state-of-the-art passivation techniques including pillar supported integral metal beam shield. (auth)

6570 (AD/A-001703) RADIATION EFFECTS IN FIBER OPTIC WAVEGUIDES. Final Report. Sigel, G. H. Jr.; Evans, B. D.; Ginther, R. J.; Friebele, E. J.; Griscom, D. L. (Naval Research Lab., Washington, D. C. (USA)). Nov 1974. 93p. NTIS $4.75.

A comprehensive review is presented on the effects of ionizing radiation on the performance of fiber optic cables, and on the materials used for fabrication of optical fibers. This includes a summary of the permanent and transient radiation-induced losses in optical transmission of state-of-the-art fibers, a detailed discussion of the mechanisms responsible for the losses observed, and a report on inhouse materials development to achieve radiation hardened fiber optic glasses. (GRA)

6571 (AD/A-001977) PHYSICS OF INTERFACE INTERACTIONS RELATED TO RELIABILITY OF FUTURE ELECTRONICS DEVICES. Final Report, 1 August 1973–31 January 1974. Distefano, T. H.; Tu, K. N. (IBM Watson Research Center, Yorktown Heights, N. Y. (USA)). 31 Jan 1974. 94p. (AFCRL-TR-74-0263). NTIS $4.75.

Topics include the reliability of semiconductor-insulator interfaces–photon induced dielectric breakdown in SiO_2, and photon assisted tunneling in internal photoemission; band structure and switching in metal oxide insulators–electronic contact barriers and morphology of Nb_2O_5 thin films, and electronic structure of the SiO_2: Si_3N_4 interface; instabilities associated with metal-glass interaction–surface reactions on MOS structures; densification of SiO_2 by exposure to an ion beam; and epitaxial growth of nickel silicide $NiSi_2$ on silicon. (GRA)

6572 (CERN-75-4) COMPARISON OF THE RADIATION DAMAGE OF ELECTRONIC COMPONENTS IRRADIATED IN DIFFERENT RADIATION FIELDS. Lambert, K. P.; Schoenbacher, H.; Van de Voorde, M. (European Organization for Nuclear Research, Geneva (Switzerland)). 14 May 1975. 26p. Dep. NTIS (US Sales Only) $4.50.

Resistors, capacitors, silicon diodes and transistors, TTL integrated circuits, and operational amplifiers have been irradiated in three different radiation environments: in a research reactor with up to 10^{15} n/cm^2 (E > 1 MeV), near a proton beam of the CERN Intersecting Storage Rings with up to 5×10^5 rad, and with a 30 kCi ^{60}Co gamma source with up to 1×10^7 rad. Representative parameters, such as resistance, capacitance, forward voltage, reverse current, toggle frequencies, have been measured before and after irradiation. It was found that, in comparison with nuclear-reactor irradiations, the effect of ^{60}Co gamma rays can be smaller by a factor of 100 or more, whereas high-dose-rate accelerator irradiation can be up to 5 times more damaging for the same nominal amount of irradiation. It is concluded that care has to be exercised when interpreting the results of radiation damage tests on electronic components in different radiation environments. (auth)

6573 (SAND-75-5251) CMOS LATCH-UP ANALYSIS AND PREVENTION. Shafer, B. D. (Sandia Labs., Albuquerque, N. Mex. (USA)). 1973. 17p. (CONF-750703-2). Dep. NTIS $4.00.

From IEEE annual conference on nuclear and space radiation effects; Arcata, California, USA (14 Jul 1975).

SCR action of parasitic PNP and NPN transistors inherent in bulk C-MOS are the cause of latch-up. Latch-up can be precluded by either limiting beta/sub npn/, beta/sub pnp/ less than 1 or by preventing lateral voltage drops from forward biasing the emitters of the parasitic transistors. Variations in circuit layouts can be used to raise the levels at which latch-up may occur. However, it is doubtful that latch-up can be fully prevented by layout modifications alone. Process variations such as n-epi on n^+ substrate and Schottky clamps on gate protection diodes should be effective in preventing latch-up. Lifetime control with neutrons is an effective method of precluding latch-up and has been demonstrated experimentally. However, longterm reliability of such devices has not been proven. (auth)

6574 (UCRL-76290) INGREDIENTS OF PROTECTION ENGINEERING. Latorre, V. R.; Spogen, L. R. Jr. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 16 Dec 1974. 7p. (CONF-750512-1). Dep. NTIS $4.00.

From electromagnetics compatibility symposium; Montreaux, Switzerland (20 May 1975).

The protection of an electronic/electrical system from an electromagnetic environment requires a systematic approach and a clear and concise identification of the data requirements and tools (analytical and experimental) for the vulnerability assessment. In this paper, a basic protection engineering concept is developed. The concept is general and therefore applicable to many systems. It consists of five stages: (1) systems analysis, (2) subsystem degradation, (3) interaction and coupling, (4) protection trade-off analysis, and (5) fabrication and operation. A detailed discussion of all functions performed in each stage is described; the input data to these functions identified; and means (tools) by which the functional operations are satisfied are summarized. Simple examples are used throughout the paper to illustrate the definitions of various functions and to emphasize the iterative process required in arriving at a protection scheme. (auth)

6575 EXPERIMENTAL EVIDENCE FOR THE EBC-AVALANCHE EFFECT IN A SILICON DIODE. Gibbons, D. J.; Hogarth, C. A.; Waters, D. G. (EMI Ltd., Hayes, Eng.). J. Phys., D (London); 8: No. 3, 262–265(21 Feb 1975).

Preliminary experimental measurements have been obtained for the electron bombardment conductivity (EBC) of a silicon diode under controlled avalanching conditions using a scanning electron microscope. It was shown that the EBC gain and the avalanche multiplication of the diode can be cascaded, and an overall current multiplication of about 2×10^5 was demonstrated on a non-optimized diode design. The calculated response time for this effect was about 100 ps. (auth)

Miscellaneous Instruments

Refer also to abstracts 7052, 7072, 7085, and 8073.

6576 (AERE-R-7299) CAMAC SHAFT POSITIONING SYSTEM. Wallace-Sims, G. R. (UKAEA Research Group, Harwell. Atomic Energy Research Establishment). Jan 1975. 17p. Dep. NTIS (US Sales Only) $4.00. UK 50 pence.

A system is described which provides for automatic angular setting to .01° of shafts on instruments controlled through CAMAC. The system is designed specifically to position shielding at a neutron diffractometer. (WHK)

6577 (CRN-CNPA-74-19) SINGLE PHOTON TIMING EXPERIMENT. Photomultiplier Time Fluctuations Study. Miehe, J. A.; Sipp, B. (Centre National de la Recherche Scientifique, 67 - Strasbourg (France). Centre de Recherches Nucleaires). 1974. 37p. (In French). INIS.

Single photoelectron time resolution measurements have been performed: the results make conspicuous the fluctuations of the transit time of the photoelectrons and the time spread of the electrons in the multiplier structure. By a single photon timing experiment a full width at half maximum equal to 270 ps has been measured. (FR)

6578 (IBK-1277) ELECTROMAGNET OF THE EXPERIMENTAL SET-UP EMA 10. Terzicj, I.; Goncicj, B.; Vukanicj, J. (Institut za Nuklearne Nauke Boris Kidric, Belgrade (Yugoslavia)). Jun 1973. 9p. (In Serbian). INIS.

The realization of the mass analyzer electromagnet of the experimental set-up with its supply is presented. The experimental set-up (called EMA 10) has been constructed with the aim of studying the interaction of low-energy ions with solids. The basic parameters of the chosen magnetic sector are: mean radius of the curve of the ion path through magnet R = 10 cm; angle of the magnetic sector = 90°; entrance and exit angles of the central ray; $\Theta_1 = \Theta_2 = 31°$; and width of the air gap d = 1.1 cm. Maximal induction in the air gap is $B_{max} = 6000$ Gauss at the 520 mA current flowing through the coil of the electromagnet and the voltage up to 300 V at its ends. The measurement supply stability of the electromagnet is better than 0.1%. (INIS)

6579 (INIS-mf-1654) CAMAC 16 CHANNEL ANALOG MULTIPLEXER MODEL 342/02-06. Gertenbach, W. P. (Atomic Energy Board, Pelindaba, Pretoria (South Africa). Instrumentation Div.). Jul 1974. 21p. INIS.

The CAMAC multiplexer model 342 is a 16 channel non-differential input analog multiplexer. Up to 8 multiplexer modules can be fed parallel to one CAMAC analog-to-digital converter module to form a 128 channel analog-to-digital converter system. The module is a single width CAMAC module and can be used in

any CAMAC crate with +6V and +15V and −15V power supply. (INIS)

6580 (ISN-TS-74-2) STERN–GERLACH MAGNET USE TO MEASURE THE NEUTRON BEAM POLARIZATION. Xiromeritis, N. (Paris-11 Univ., 91–Orsay (France)). 1974. 73p. (In French). INIS.

Thesis.

Several kinds of Stern–Gerlach apparatus have been developed and tested, as analyzer of neutron polarization. The inherent disadvantages of the classical Stern–Gerlach magnet have been minimized. With reasonable care, it is possible to reach an accuracy better than 1% for either cold or thermal neutron spectra. (INIS)

6581 (JINR-P13-8705) SENSITIVE SHAPERS ON INTEGRAL SCHEMES. Boretko, V. F.; Grebenyuk, V. M.; Zinov, V. G. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 10p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

Two shapers are described. One of the peculiarities of them is a discriminating element which represents a combination of a tunnel diode and microschemes of the ESL series. The shapers operate in two modes, i.e., forming an output signal rise time and without it. One of them has a sensitivity of 25 mV, the second one 2 mV, the maximal speed of response being 100 and 50 MHz, respectively. (auth)

6582 (MLM-2222(OP)) COMPUTERIZED AUTOMATED PRESSURE/VOLUME CALIBRATION SYSTEM. Shaffer, R. L.; Homan, D. A. (Mound Lab., Miamisburg, Ohio (USA)). 18 Apr 1975. Contract AT-33-1-GEN-53. 38p. (CONF-750457-1). Dep. NTIS $4.00.

From Monsanto process computer symposium; Springfield, Massachusetts, USA (7 Apr 1975).

An automated pressure/volume calibration system was designed and developed for application by Mound's Standards Laboratory. The system utilizes laboratory equipment to measure pressure, temperature, and vacuum precisely. The data obtained from these measurements and the value of a known standard volume are used to calculate an unknown volume for gas containment to an accuracy of approximately +−0.3 percent. The process utilizes the forward-reverse substitution technique which eliminates the need for a separate determination of the plumbing volume. The technique is usable for volumes that are regular or irregular in shape, and is not limited in size restrictions as long as an adequate standard volume is available. This automated system under minicomputer control has increased by threefold the number of volume calibrations that can be performed in a given period of time with a large reduction in direct labor costs. The system can perform a volume calibration with documentation in a continuous twenty-four hour period with minimal manpower requirements, whereas the original manual system required one man three working days to accomplish the same task. (auth)

6583 (SFB-MHD-12) OPERATIONAL PRESSURE MEASUREMENTS ON ALKALI METAL LOOPS AT TEMPERATURE UP TO 800°C BY DIRECT COUPLING OF THE PRESSURE TRANSDUCER. Kaack, W.; Schergun, P.; Wagner, K. (TECHNISCHE Univ. Berlin (F. R. Germany). Sonderforschungsbereich Magnetohydrodynamik). Jan 1974. 28p. (In German). Dep. NTIS (US Sales Only) $4.50.

The direct connection of commercial pressure transducers to an alkali-metal-loop at high temperature up to 800°C has been developed. The medium in the measuring pipe is the alkali-metal itself. The mechanical and electrical setup of the experimental apparatus are described. The system worked well at all temperatures up to 800°C. The error of the measurements was within the limits given by the pressure-transducer. (auth)

6584 (TID-26736) SODIUM IONIZATION LEAK DETECTOR. Monthly Progress Letter Report for January, 1975. (Westinghouse Electric Corp., Hunt Valley, Md. (USA). Nuclear Instrumentation and Control Dept.). 14 Feb 1975. Contract AT(11-1)-2499. 4p. Dep. NTIS $4.00.

Progress in development and testing of the sodium ionization leak detector is reported. (WHK)

6585 (UCRL-51742) REDUCED, A DATA REDUCTION CODE. Maron, N. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 22 Jan 1975. Contract W-7405-eng-48. 32p. Dep. NTIS $4.00.

REDUCED, a Fortran program currently running on a Lawrence Livermore Laboratory (LLL) CDC 6600, provides a simple means of accumulating a large base of experimental data (up to 21 parameters for up to 500 experiments) and interactively making two-dimensional plots of any pair of functions of the parameters. For each experiment, each pair of function values is displayed as a discrete point. Linear or quadratic least-squares fits to the array of these points can be drawn. Results can be displayed on a variety of output media including printer/plotters, COM and CRT devices. User inputs required include a data base of parameter values; specification of functions to be performed; specification of symbols to appear on the actual plots; and necessary control cards. This report includes a description of REDUCED, instructions on how to use it, and a source listing of the complete code. (auth)

6586 TSIFROVYE INFORMATSIONNYE SISTEMY I USTROISTVA. Tom II. (Digital Data Systems and Devices. Volume II). Kurochkin, S. S.; Murin, I. D. Sovremennaya Yadernaya Elektronika, Tom II. Moscow; Atomizdat (1975). 288p.

This book deals with digital devices for accumulating and treating data in experimental nuclear physics. Consideration is given to methods of creating the digital devices, and features in creating these devices for use in nuclear physics. A description is given of modern integrating microelements for digital use. Examples are given of basic digital devices used in nuclear electronics such as counters and scalers, data registers and converters, devices for preliminary selection of data and memory devices, arithmetic units and control units made to the specifications of the systems "VEKTOR" and "SAMAS". A description is given of digital measuring systems used in experimental nuclear physics: multichannel and multidimensional analyzers, multichannel counting system, correlators, etc. Methods of using computers in modern physics experiments are also analyzed. Numerous examples are presented of concrete industrially-available equipment of the third generation used in nuclear physics and the atomic energy field. (tr-SJR)

6587 IMAGE ABERRATIONS PRODUCED BY THE FIELD ERRORS AND BY THE MECHANICAL ERRORS IN DOUBLE FOCUSING MASS SPECTROMETERS FOR MOLECULAR PROCESS STUDIES AND ISOTOPE ANALYSIS. Ioanoviciu, D.; Cuna, C.; Mihaila, A. (Inst. for Stable Isotopes, Cluj). Rev. Roum. Phys.; 19: No. 9, 963-973(1974).

Supplementary aberrations in double focusing mass spectrometers due to the incorrect machining and alignment were calculated. Several errors concerning the double focusing systems are discussed. Then the tolerances can be prescribed to reach the desired performance. (auth)

6588 OPTIMIZATION OF THE PULSE-SHAPE DISCRIMINATOR. Petr, I. Jad. Energ.; 21: No. 3, 100-104(Mar 1975). (In Czech).

A short review of the pulse-shape discrimination methods and the analysis of the zero-crossing method is given. The derived optimizing criterion for the zero-crossing pulse-shape discrimination generalizes the criteria presented till now. The theoretical results are confirmed by the experiment. (auth)

6589 DESCRIPTION AND PERFORMANCE OF A HIGH RESOLUTION ELECTRON SPECTROMETER. Roy, D.; Delage, A.; Carette, J. D. (Laval Univ., Quebec). J. Phys., E (London); 8: No. 2, 109-114(Feb 1975).

The description of a high resolution electron spectrometer comprising an electron gun, electrostatic lenses, a 127° cylindrical monochromator and analyzer, and a collision chamber with rotatable exit slit, is presented. Its performance is illustrated by a neon energy loss spectrum and transmission measurements of helium and neon resonances. An analysis of these resonances is also carried out, and values of their energy widths and phase shifts are determined. (auth)

6590 ON-LINE MASS SPECTROMETRIC METHOD FOR THE DETERMINATION OF GASEOUS RADIATION DECOMPOSITION PRODUCTS FROM SOLIDS. Jarmany, H.; Farrell, G.; Boswell, G. G. J. (Salford Univ., Eng.). Vacuum; 25: No. 2, 57-60(Feb 1975).

A mini-mass spectrometer has been coupled to an irradiation cell, with the cell adjacent to a 10 kCi ^{60}Co source. The mass spectrometer was sited outside a shield wall and connected to the irradiation cell by 10 m of tubing. This arrangement enables quantitative and qualitative measurements of gaseous radiation decomposition products to be made. It is shown that the mass spectrometer reading on the hydrogen peak is directly proportional to the $G(H_2)$ values of a range of compounds. (auth)

6591 CALIBRATION OF MEASURING EQUIPMENT. Rattray, H. D. (United Kingdom Atomic Energy Authority, Springfields). Metrol. Insp.; 7: No. 2, 15-21(Apr 1975).

This article is concerned with the calibration of absolute measuring equipment used to record the dimensions on a variety of nuclear reactor components varying from small spheres of 500 μm dia. and conventional length and diameter on numerous

types of specimens to a method of ultrasonically determining wall thickness on tubing. (UK)

6592 DATA ACQUISITION SYSTEM FOR THREE-DIMENSIONAL TREATMENT PLANNING. Mantel, J.; Perry, H.; Weinkam, J. J. (Sinai Hospital, Detroit). Radiology; 115: No. 1, 187-189 (Apr 1975).

The authors describe a coordinate measuring device developed to simplify manual acquisition of the digital information required for computerized three-dimensional treatment planning. This system has been used for two years and shown to be both fast and accurate. The time needed to digitize contour data is reduced to approximately one-tenth of that required for manual methods in most cases. (auth)

ISOTOPE AND RADIATION SOURCE TECHNOLOGY

Isotope Separation (Industrial)

Refer also to abstracts 6385, 6386, 6398, and 8391.

6593 (BNWL-tr-144) CENTRIFUGE FOR SEPARATION OF ENRICHED ^{235}U. Ohyama, Y.; Takashima, Y.; Aoki, N. (Power Reactor and Nuclear Fuel Development Corp., Tokyo (Japan)). 30 Apr 1975. Translation of Japanese Patent 1973-11278. 12p. Dep. NTIS $4.00.

The invention claim is for a centrifuge for enrichment of ^{235}U characterized by: (1) a rotor provided with hollow upper and lower rotating shafts which serve, respectively, as a feed conduit for a light inert-gas/UF_6-gas mixture and as a discharge conduit for the light inert gas, and provided with top and bottom end-plates having vents for discharging the ^{235}U-enriched gas and ^{235}U-depleted gas in equal amounts; (2) a fixed outer jacket which accommodates the freely rotating rotor in such a manner as to form annular slits between the shoulders of the rotor and the inner wall of the jacket, and is equipped at the mid-section with gas-inlet conduits for injecting the inert light gas into the annular space between the rotor and the jacket through the openings provided at the tips of the conduits in the direction of the rotor's rotation and also tangentially to the rotor, and is further equipped near the top and bottom with gas-outlet conduits fitted with control valves; and (3) heating and cooling units installed at the top and bottom of the annular space between the rotor and the jacket. (auth)

6594 (CEA-R-4663) THEORETICAL NOTIONS IN ISOTOPE SEPARATION. Jacques, R. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Div. de Chimie). Jun 1975. 27p. (In French). Dep. NTIS (US Sales Only) $4.50.

The enrichment equation for a cascade formed by separator elements with one input and two outputs was established. It is shown that this equation may be applied to other configurations, i.e., systems with plates or with a continuous countercurrent. Essential properties of ideal cascades are demonstrated, in particular, one of the minimum total flow. The separation power is introduced as a characteristic value, proportional to this flow, dependant only of the inputs and outputs of an ideal cascade. This notion may be extended to stages, and cascades of any sort, and allows one to define an efficiency, measuring the incidence of the concentrations mixing on the cascade volume. The optimization of a separating plant must minimize its total volume, or maximize its efficiency, by an appropriate cascading. On another side, the waste assay must be chosen as to realize a compromise between the price of the feed and that of the separation. The last chapter is devoted to some considerations on the transient regimes. Two methods are presented, to evaluate the equilibrium time; these evaluations are based upon the balance of the enriched product and that of the separating power. (auth)

6595 (CONF-750317-) AIF FUEL CYCLE CONFERENCE '75, ATLANTA, GEORGIA, MARCH 18-21, 1975. Remarks Presented by ERDA and UCC Representatives. (Atomic Industrial Forum, Inc., New York (USA)). 1975. 80p. Dep. NTIS $5.45.

Separate abstracts were prepared for each of the four talks. (MCG)

For abstracts of individual papers see: 6384, 6596, 6597, and 8387.

6596 (CONF-750317-, pp 37-50) SUPPLY AND DEMAND CONSIDERATIONS IN URANIUM ENRICHMENT. Baranowski, F. P. (Div. of Production and Materials Management, Washington, DC). 1975.

From atomic industrial fuel cycle conference; Atlanta, Georgia, USA (18 Mar 1975).

In AIF fuel cycle conference '75.

On January 6, 1975 a proposed increase in cascade transaction tails assay and related items were announced. Comments subsequently received have generally favored selection of an assay lower than the proposed 0.275 percent in the period 1976 through 1981. Recent reactor deferrals and possible cancellations resulted in ERDA's proposing a relief option on separative work to utilities with fixed-commitment contracts. Following indications from some customers that this option was of no assistance to them, ERDA requested suggestions which would be of assistance, and those received are being considered and measured against the ERDA objectives of stockpile buildup and maintenance of a viable uranium producing industry. The amount of deferrals, contract cancellations, and the final tails assay selection for the cascade operating plan will determine the size of the preproduction stockpile and the quantity and timing of feed deliveries to ERDA. The presentation breaks down the demand between that supplied by the existing U. S. gaseous diffusion plant complex and that supplied by new plants. Additional new enrichment capacity is expected to be needed in the U. S. by the mid-1980's. ERDA has an active development program on new techniques and has a continuing access permit program with the purpose of transferring both technology and design data to industry for planning its role in supplying new plant capacity to meet the demand. To provide assurance of fuel supply to customers desiring enrichment services from U. S. plants, there is a need for a contingency stockpile to support ERDA existing contractual commitments and a reserve stockpile to assist the early startup of new plants and a need to maintain high reliability of operation of existing and new plants. This assurance depends also on the balance of uranium mines and mills, enrichment plants, and reprocessing plants assumed to meet the fuel needs of reactors. (auth)

6597 (CONF-750317-, pp 51-76) ENRICHMENT OPERATIONS OUTLOOK. Sommerfeld, K. W. (Union Carbide Corp., Oak Ridge, TN). 1975.

From atomic industrial fuel cycle conference; Atlanta, Georgia, USA (18 Mar 1975).

In AIF fuel cycle conference '75.

The U. S. gaseous diffusion plants have achieved an admirable record of performance and reliability, and there is confidence it can be maintained through the rest of this century. In addition to aggressive regular maintenance, three specific programs are combined to maximize the reliability of the plants: A Deferred Maintenance Program to restore production equipment and associated auxiliary systems; a Cascade Improvement Program (CIP) to install new and improved technology such as rebuilt and more efficient compressors, piping and control valves with better aerodynamic characteristics, and new and improved barrier; and a Cascade Uprating Program (CUP) to refurbish and add capacity to electrical and process cooling systems. A three-plant steering committee has been formed to examine in detail all aspects of enrichment facilities not already covered by these three specific programs, and task forces have been assigned to investigate in depth long-term reliability in these areas. In many cases, specific testing programs have been designed to evaluate the potential life of components, and information from commercial industries is routinely used. Where deficiencies are found, capital budget items are submitted and corrective action planned. Existing experience is available to those industries concerned with new plant ventures, and the Industrial Participation Program is one example where private industry can take full advantage of this existing experience. (auth)

6598 (LA-UR-75-642) LASER ISOTOPE SEPARATION. Robinson, C. P. (Los Alamos Scientific Lab., N. Mex. (USA)). [nd]. Contract W-7405-eng-36. 20p. (CONF-750460-2). Dep. NTIS $4.00.

From 3rd conference on the laser; New York, New York, USA (22 Apr 1975).

The fundamental principles and kinetic parameters of laser isotope separation are presented. (TFD)

6599 (UCRL-51796) ISOTOPE SEPARATION BY LASER DEFLECTION OF AN ATOMIC BEAM. Bernhardt, A. F. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Feb 1975. Contract W-7405-eng-48. 108p. Dep. NTIS $5.45.

Thesis.

Separation of isotopes of barium was accomplished by laser deflection of a single isotopic component of an atomic beam. With a tunable narrow linewidth dye laser, small differences in absorption frequency of different barium isotopes on the $6s^2\ ^1S_0$–$6s6p\ ^1P_1$ 5536A resonance were exploited to deflect atoms of a single isotopic component of an atomic beam through an angle large enough to physically separate them from the atomic beam. It is shown that the principal limitation on separation efficiency, the fraction of the desired isotopic component which can be separated, is determined by the branching ratio from the excited state into metastable states. The isotopic purity of the separated atoms was measured to be in excess of 0.9, limited only by instrumental uncertainty. To improve the efficiency of separation, a second dye laser was employed to excite atoms which had decayed to the 6s5d metastable state into the $6p5d\ ^1P_1$ state from which they could decay to the ground state and continue to be deflected on the 5535A transition. With the addition of the second laser,

separation efficiency of greater than 83 percent was achieved, limited by metastable state accumulation in the $5d^2\ ^1D_2$ state which is accessible from the $6p5d\ ^1P_1$ level. It was found that the decay rate from the 6p5d state into the $5d^2$ metastable state was fully 2/3 the decay rate to the ground state, corresponding to an oscillator strength of 0.58. (TFD)

6600 (UCRL-76540) ISOTOPE SEPARATION USING TUNABLE LASERS. Snavely, B. B. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 15 Apr 1975. 14p. (CONF-750621-1). Dep. NTIS $4.00.

From international conference on lasers and opto-electronics; Munich, F.R. Germany (24 Jun 1975).

Various processes for laser isotope separation based upon the use of the spectroscopic isotope effect in atomic and molecular vapors are discussed. Emphasis is placed upon processes which are suitable for uranium enrichment. A demonstration process for the separation of uranium isotopes using selective photoionization is described. (auth)

6601 (UCRL-76601) LASER ISOTOPE SEPARATION OF URANIUM. Hartford, A. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 15 Apr 1975. 23p. (CONF-750627-1). Dep. NTIS $4.00.

From 8th AIAA Fluid and plasma dynamics conference; Hartford, Connecticut, USA (16 Jun 1975).

The fundamental spectroscopic and kinetic parameters required for laser isotope separation are described. An experiment demonstrating selective photoionization of ^{235}U in a beam of the metal vapor is reviewed. (TFD)

6602 METHOD OF CONTINUOUS PRODUCTION OF TUBULAR BARRIERS FOR USE IN GASEOUS ISOTOPIC SEPARATION. Kamizyo, E.; Nishimoto, T.; Ishida, R. (to Sumitomo Electric Industries Ltd.). Japanese Patent 1973-8080/B/. 4 Aug 1969. 4p. (In Japanese).

A tubular barrier of $\leq 50\ \mu$ in thickness having pores 100 to 300 Å in diameter with a distribution density of $10^{10}/cm^3$ is reinforced with one or a number of layers of such sintered materials as metals, ceramics, and high molecular organic compounds with a diameter of 0.5 to 30 μ. A press-formed sheet is sintered in a furnace. A sintered sheet is laminated with an aluminum foil which is wider than the sintered sheet. The laminated sheet is heated with rollers between which electric current flows. The adhered sheets are processed to form a pipe and the marginal portions of aluminum foil are welded. Then the portion of aluminum is anodized with direct current between the cathode in the center of the pipe and the pipe, while electrolyte is circulated. Ni powder of 30 μ-diam particle size is formed, by sintering, into a sheet which is 0.5 mm thick, 67 g/cm^3 in density, 25% in porosity, and which has a pore diameter of 10 μ. A 50-μ-thick aluminum foil is rolled with the sintered sheet under a pressure of 20 kg/cm^3, at 50 V, 1.55 A. TID welding is carried out with an electrode of W-ThO_2 alloy. A 25-mm × 50-cm pipe is anodized with 10% H_2SO_4 at 25°C, 25 V for 30 min; permeability of the pipe thus produced is 8×10^{-6} mol.air/cm.cmHg.min., and its separation efficiency is 88%. (JA)

6603 HEAVY WATER INDUSTRY. Haywood, L. R.; Lumb, P. B. (Atomic Energy of Canada Ltd., Ottawa). Chem. Can.; 27: No. 3, 19-21(Mar 1975).

The Canadian heavy water industry is now the largest in the world, and by the end of this decade will have an annual production in excess of 4000 Mg valued at approximately half a billion dollars. By 1980 the industry will employ 2000 in its plants, including approximately 400 professionals, and have a two billion dollar capital investment. A typical GS plant processes 30 million tons of feed water each year, and safely handles large quantities of hydrogen sulfide. Safety, environmental and corrosion control measures are rigorous. Extensive equipment and process development programs are underway to improve productivity and reduce costs for GS and new heavy water processes. (auth)

Isotopic Power Sources

Refer also to abstracts 6227–6229, and 6369.

6604 (CEA-CONF-2900) ROLE OF NUCLEAR ENERGY IN THE EXPLOITATION OF THE DEEP OCEAN. Devin, B.; Boutaine, J. L.; Galaud, G.; Alleau, T.; Schwartz, J. P.; Mabile, M. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Dept. de Transfert et Conversion d'Energie; CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. des Radioelements; CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physique des Reacteurs et de Mathematiques Appliquees; CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Propulsion Nucleaire). 1974. 22p. (In French). INIS.

From 9th world energy conference; Detroit, Michigan, USA (22 Sep 1974).

For all kinds of deep sea operation (habitat, ore recovery) the nuclear energy possesses the inherent qualities of reliability, long life, and autonomy in the whole power range. These factors become essential for economic deep sea operations. Realisations and system projects within four power ranges are presented: very low range: (under 1 kW) covered by direct conversion isotope generators (thermoelectric); low range: (1kW to 10kW) covered by isotope thermodynamic system; medium range: (10kW to 1 MW) covered by direct conversion nuclear reactors (thermionics); upper range: (above 1 MW) covered by the low scale PWR system. Economic evaluation of these systems is given and the cost evolution analysed. (GE)

6605 (COO-2155-15) BIOMEDICAL ENGINEERING SUPPORT. Quarterly Progress Report, November 16, 1974–February 15, 1975. Kolff, W. J.; Smith, L. M.; Sandquist, G. M. (Utah Univ., Salt Lake City (USA)). 1975. Contract E(11-1)-2155. 32p. Dep. NTIS $4.75.

During the quarter covered by this progress report, two implantation experiments in calves were conducted to further develop surgical procedures as well as to assess the overall performance and adequacy of the AEC blood pump and ventricles. Both experiments were directed primarily at determining and improving pump and ventricular efficiency, improving surgical procedures and evaluating the reliability of the blood pump components, which include the flexible drive shaft, the blood pump drive mechanism and the blood handling components. Results of the experiments are presented. (TFD)

6606 (DPST-75-128-4) ^{238}Pu FUEL FORM PROCESSES. Savannah River Laboratory Monthly Report. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.). Apr 1975. Contract AT(07-2)-1. 25p. Dep. NTIS $4.25.

In PuO_2 characterization studies, the following items were observed: Individual PuO_2 particles calcined from plutonium oxalate contain sub-micron crystallites. An increase in the size of these crystallites with temperature determines the specific surface area of the powder. These crystallites become comparable in size to the particles at 1000°C; excessive crystallite growth significantly above 1000°C affects ball-milling response and behavior during cold-compaction. Initial measurements of pour and tap densities of $^{238}PuO_2$ powder show trends that may permit evaluation of feed sinterability in the as-calcined condition. Response of feed produced between October 1973 and August 1974 to comminution in the SRL mill is less than that for SRP $^{238}PuO_2$ production batches produced before or after this period. Particle size, milling response, and hot-pressing behavior of current SRP $^{238}PuO_2$ feed closely approximate these characteristics for feed produced prior to October 1973 than for the feed produced between October 1973 and August 1974, which has exhibited excessive sinterability. Studies with 2- to 5-g pellets from $^{238}PuO_2$ produced after August 1974 showed: pure plutonium oxide (PPO) spheres can be fabricated from this powder with acceptable densities. 90% low cost, high performance (LCHP) pellets cannot be obtained with this powder without modifying the centerline parameters for hot pressing. (auth)

6607 (HIT-321) VENTING HELIUM FROM ENCAPSULATED ALPHA-EMITTING RADIOISOTOPE HEAT SOURCES. (Hittman Associates, Inc., Columbia, Md. (USA)). Jun 1968. 34p. Dep. NTIS $4.75.

Declassified 21 Jun 1972.

A materials survey was conducted to tentatively select the most promising matrix and vent materials for use in a fiber composite helium vent operating at temperatures up to 1500°C. Based on the criteria of high temperature stability, helium permeability, compatibility, thermal expansion, and fabricability, platinum was selected for evaluation as the matrix material and zircon mullite containing 15 percent of a refractory glassy phase was selected for evaluation as the vent material. (auth)

6608 (MND-3607-239-2) SNAP 19, PHASE III. Volume II. Heat Sources. Final Report. (Martin Marietta Corp., Baltimore, Md. (USA)). May 1968. Contract AT(30-1)-3607. 181p. Dep. NTIS $12.25.

Declassified 28 Nov 1973.

The phases of the SNAP-19 program and particularly the development of encapsulated PuO_2 microspheres as the intact reentry heat source are described. Information is included on

heat source design and characteristics; handling and shipping; and development and qualification tests. (LCL)

6609 METHOD OF HEATING AN OBJECT. Nishikawa, M.; Imai, M.; Yuhara, I.; Inoue, K. (to Hitachi Ltd.). Japanese Patent 1973-19840/B/. 3 Dec 1970. 2p. (In Japanese).

The present invention relates to a method of locally heating an object, in which a (n, α) reactive material is placed at the portion of the object to be heated, and then heating the reactive material by irradiating it with neutrons from a reactor. The object of the present invention is to facilitate local heating of an object which is difficult to achieve by conventional methods such as resistance furnaces, induction furnaces, or high-temperature gases, etc. In the present invention, BN_2 is imbedded inside the object to be heated, and is then irradiated by a neutron beam. The (n, α) reaction of ^{10}B in BN_2 with neutrons produces heat. When the heating of the whole material is desirable, BN_2 powder may be dispersed homogeneously inside the object. (JA)

6610 BENEFIT/RISK ANALYSIS OF CARDIAC PACEMAKERS POWERED BY BETACEL ^{147}Pm BATTERIES. Smith, T. H.; Greenborg, J.; Matheson, W. E. (Douglas Labs., Richland, WA). Nucl. Technol.; 26: No. 1, 54-64(May 1975).

Cardiac pacemakers powered by Betacel ^{147}Pm nuclear batteries are undergoing clinical evaluation in Europe and the United States. This benefit/risk study analyzes the potential effects from unrestricted use of 20,000 pacemakers powered by these betavoltaic batteries. The beneficial effects of this device (lives saved and reduced medical expenses) result from improved reliability and operating lifetime (approximately 9 yr) compared with widely available chemical batteries of substantially shorter life (approximately $2\frac{1}{2}$ yr). Calculated benefits are $16,800,000/yr savings to society and 76 lives (approximately 800 life-years) saved per year. Risks to the patient and the general population are generally less than those from natural accidents such as landslides and lightning strikes. The calculated benefit/risk ratios of 180 in terms of lives and 440 in monetary terms are in the range commonly accepted by the public. (auth)

Radiation Sources

Refer also to abstracts 6692 and 7881.

6611 (CEA-N-1780) POTENTIAL APPLICATIONS FOR ^{252}Cf. Berger, R. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Genie Radioactif). Jan 1975. 22p. (In French). INIS.

An analysis of three American surveys on potential markets for devices using ^{252}Cf is presented. According to the information for the present ^{252}Cf price and taking a probability level of 0.5 the business value of ^{252}Cf devices should increase from $2.3 million (FF 11.4 million) in 1974 to $13 million (FF 65 million) in 1980. The cumulative 1974-1980 U.S. totals involve the sale of more than 1000 devices for a total of $49 million (FF 245 million). The foreign market may equal or exceed these figures. Twenty-five end uses in eight market segments are now recognized. On-stream process control and nuclear materials assay will account for more than half on the cumulative 1974-1980 market for ^{252}Cf devices. Two major industries, nuclear power and Portland cement, appear to be good potential customers for these devices. (FR)

6612 COMPARISON OF FLUX DENSITY DISTRIBUTIONS FROM MASSIVE OR RING-SHAPED ISOTOPIC NEUTRON SOURCES. Alaerts, L.; Op de Beeck, J. P.; Hoste, J. (Rijksuniversiteit, Ghent). J. Radioanal. Chem.; 25: No. 1, 155-161 (1975).

A comparison was made between flux density distributions from massive and ring-shaped cylindrical isotopic neutron sources. A considerable gain in direct fast neutron flux was obtained for the latter geometry as well as a neat separation of fast and thermal flux density maxima along the axis of the source. Applications of these favorable properties are discussed. (auth)

Design and Fabrication

6613 EFFECT OF ABSORPTION EDGE FILTERS ON DIAGNOSTIC X-RAY SPECTRA. Atkins, H. L.; Fairchild, R. G.; Robertson, J. S.; Groenberg, D. (Brookhaven National Lab., Upton, NY). Radiology; 115: No. 2, 431-437(May 1975).

The spectra of diagnostic x-ray beams were measured with a germanium semiconductor detector. With this system it was possible to define the k/sub alpha 1, k/sub alpha 2/, k/sub beta 1/, and k/sub beta 2/ characteristic peaks of the tungsten target. The effects of various filters on the beam using characteristic absorption edges to create a "bandpass" effect were studied. Gadolinium filtration of the diagnostic beam used for contrast studies selectively removed both higher energy photons (greater than 50 keV) and lower energy photons (less than 33 keV) thus enhancing contrast for iodine and barium while substantially reducing radiation dose. (auth)

6614 TIMING DEVICE USED AT RADIATION DOSIMETER CALIBRATION. Samuelson, G.; Bengtsson, L. G. (National Inst. of Radiation Protection, Stockholm). Health Phys.; 28: No. 4, 464-466(Apr 1975).

The exposure rate from a radiation source which is "activated" by the removal of say a shutter, rises to a maximum, remains constant and on termination of the exposure, decreases to zero. Errors arise in the measurement of the total exposure since the timing of the exposure is normally taken from the beginning of the rise to the end of the fall to zero. A timing circuit is described here with which the effective exposure time can be determined, limited mainly by the precision of the exposure system and not by the time taken to remove and replace the source shield. (UK)

Industrial Uses

6615 APPLICATION OF RADIATION TO PRODUCTION OF WIRES AND CABLES. Oda, E.; Takaishi, T. (Furukawa Electric Co. Ltd., Tokyo (Japan)). FAPIG (Tokyo); No. 73, 34-44(Jun 1974). (In Japanese).

The most important of the applications of radiation to the production of wires and cables is the cross-linking of insulators by radiation. A specific problem in the wire and cable irradiation with electron beam accelerators is the low efficiency due to the construction of wires and cables which makes the effect of irradiation unattainable to the opposite side of wires or the rear part of conductors. Insulators to be reformed are required to have a high cross-linking ratio of 50% or more. The cross-linking of polyvinyl-chloride (PVC) is difficult, while polyethylene is easy. Acceleration of the PVC cross-linking is being studied. Occurrence of Lichtenberg's figure, generation of hydrogen, and sparks from conductors are other problems. The advantage of the wires and cables irradiated for cross-linking is that the low cost materials such as PVC and polyethylene are reformed by cross-linking and their characteristics are changed by combining some additives. Electron beam accelerators are the lowest cost radiation sources at present as compared with radioisotopes and reactors for chemical use. (JA)

6616 PROCESSING OF RESPONSE FUNCTIONS OBTAINED BY RADIOTRACER MEASUREMENTS. III. Systems With Recycling. Thyn, J. (Vyrobu a Vyuziti Radioisotopu, Prague). Radioisotopy.; 16: No. 2, 243-296(Apr 1975). (In Czech).

A short survey of methods for the residence time distribution analysis in linear systems where a part of the outflow stream is recycled to the inlet is presented. Two methods making use of the Laguerre functions, i.e., the direct method and the minimum error method, are described for cases where the response of the system is investigated by means of radiotracers. Both methods were tested in simulated experiments for such conditions where the recycled stream reenters immediately and without change of the distribution function into the system inlet. The experimental functions were prepared by superimposition of random fluctuations to the function obtained for a series of ideally stirred vessels. The abilities of the direct method were further investigated also for cases where a flow delay occurs in the recycling portion. The stability and convergency of both methods is good even in cases where experimental data with considerable fluctuations are treated. The direct method yields in a number of simulated cases better results than the minimum error method. Another drawback of the minimum error method is that the calculation is more time consuming and expensive and the program contains a greater part of the computer memory than with the direct method. (auth)

6617 APPLICATION OF RADIATION TECHNOLOGY IN INDUSTRIAL PROCESSES. Current and Future Perspectives. Silverman, J. (Univ. of Maryland, College Park). Int. At. Energy Agency Bull.; 17: No. 1, 15-22(Feb 1975).

The development of nuclear power has been responsible for many by-products, among them radioactive fission products. In the late 1940's and early 1950's considerable efforts were made to develop industrial processes that could make use of the fission products in large quantities. Although some fission products are utilized today, the scale does not approach the quantities that will be produced in a nuclear economy. The efforts have not been a failure, however, and the research to develop industrial processes has created markets, not for the

fission products as one had hoped, but for the radioisotope ^{60}Co produced by neutron capture in a nuclear reactor, and for accelerators—machines that produce radiation in a controlled manner. Success in finding uses for the major fission products may yet come, as research continues in the radiation chemistry and radiation biology fields. Radiation processing is now a vigorously expanding area because of sharp increases in the reliability of electron beam generators, sharp drops in the unit cost of both electron beam power and electron beam energy, significant advances in radiation chemistry leading to lower dose requirements and increased engineering knowledge and practical experience. The principal reasons for its bright future promise arise from expectations of further sharp decreases in the unit cost of electron beam energy and from the recent successful adoption of radiation on a large scale for cross linking of telephone wire insulation in the United States. (auth)

6618 GAMMA RAY DISTANCE INDICATOR. Hsu, C. C.; Chiang, L. J.; Hsieh, P. H.; Li, C. K. (Shanghai Inst. of Atomic Nuclei). Wu-li; 3: No. 3, 139–141(18 Jun 1974).

An experiment using a gamma ray detector to measure the trajectories of rifle bullets implanted with a 1 × 10 mm, 21.5 millicurie ^{60}Co filament as a radioactive source is described. A polystyrene plastic ball scintillator, 15 cm in diameter, absorbs the gamma photons and emits blue light pulses at 4200 to 4800 Å which are converted into electric pulses by a GDB-10 photomultiplier. The pulses are amplified, reconstructed as electric signals, and introduced into a recording system consisting of three tracks of frequency dividers (themselves each consisting of two 3DK3B transistors), integrated circuits, and an SC-10 oscillator oscillograph. (JPRS)

6619 IONIZING RADIATIONS: THE SOURCES AND THE EFFECTS. Application to Glass-Ceramic Formation. Igonet, C. Verres Refract.; 28: No. 6, 213–222(Nov 1974). (In French).

The main factors which influence the choice of an irradiation source for industrial application are reviewed. The irradiation sources for initiating nucleation in glasses, as a method of preparing glass-ceramics, are extensively studied. (FR)

6620 PRACTICAL ASPECTS OF THE ^{85}Kr LEAK DETECTOR. Mulder, P. P. (Philips Gloeilampenfabrieken N. V., Eindhoven, Netherlands). Ned. T. Vacuumtechniek; 13: No. 5, 8–13(Jan 1975). (In Dutch).

The ^{85}Kr leak detector is an apparatus which can detect leaks in hermetically sealed objects. ^{85}Kr is a radioisotope of krypton, which emits mainly β^- particles (672 keV) and γ-rays (513 keV), with a half-life of 10.8 years. Under normal conditions the minimum detectable leak is about 10^{-15} torr l/s. Besides some practical aspects of the apparatus, the measuring method and the conditions under which the given limit is obtainable, a quantity of measuring-results is also given. (auth)

LIFE SCIENCES

Radiation Effects on Biochemicals

Refer also to abstracts 5999, 6019–6021, 6717–6720, 6727, 6728, 6730, 6731, 6733, and 6754.

6621 (ERDA-tr-1, pp 17-21) INFLUENCE OF IRRADIATION ON THE PROPERTIES OF RECONSTITUTED NUCLEOHISTONES. Umanskii, S. R.; Korol, B. A.; Runova, Yu. N.; Tokarskaya, V. I. (Inst. of Biological Physics, Pushchino, USSR). May 1975. Translated from Radiobiologiya; 14: No. 5, 656-660 (1974).

In radiobiology.

Greater solubility of complexes of total histones and their F_1, F_{2a}, F_{2b}, and F_3 fractions with irradiated DNA was detected in comparison with their complexes in native DNA. The histones more weakly suppress the template activity of irradiated DNA in the RNA polymerase system. It was shown that γ-irradiated DNA is capable of binding a smaller amount of all the fractions of histones than native DNA, but more than is detected in the chromatin of cells of higher organisms. (tr-auth)

6622 (ERDA-tr-1, pp 27-31) MONOLAYER MEMBRANES OF THE PROTEIN-POLYSACCHARIDE COMPLEX AND THE EFFECTS OF UV RAYS ON THEM. Tongur, A. M.; Volkova, M. S.; Pavlovskaya, T. E. (Inst. of Biochemistry, Moscow). May 1975. Translated from Radiobiologiya; 14: No. 5, 665-668(1974).

In radiobiology.

The surface and barrier properties of nonirradiated and uv-irradiated monolayers of the protein-polysaccharide complex were studied in the work. It was shown that monolayers of the protein-polysaccharide complex are specifically oriented on the surface. They possess high elastic properties, which are unchanged by uv irradiation. Evidently, precisely these properties explain the stabilizing effect of the polysaccharide complex in the cell membranes. It was established that monolayers of the complex, forming the interface between the enzyme and substrate, do not manifest barrier properties, observed in the case of monolayers of lipovitelline and DNP, studied under analogous conditions. Evidently, the specific localization of the complex on the surface provides for a reticular structure of the monolayer. (tr-auth)

6623 (ERDA-tr-1, pp 108-110) INFLUENCE OF GAMMA IRRADIATION ON THE FREQUENCY OF ENCOUNTER OF PYRIMIDINE AND PURINE OLIGONUCLEOTIDES OF DNA OF THE COTTON PLANT. Aripdzhanov, Sh. A.; Ibragimov, A. P. (Inst. of Biochemistry, Tashkent). May 1975. Translated from Radiobiologiya; 14: No. 5, 733-736(1974).

In radiobiology.

The influence of γ irradiation on the frequency of encounter of pyrimidine and purine nucleotides of the total DNA of the cotton plant was studied. It was concluded on the basis of the experimental results that in the irradiation of cotton seeds there is a degradation of longer nucleotide blocks of DNA and a redistribution of them within the individual isopleths. The purine oligonucleotide blocks are more radiosensitive. (ERB)

6624 (ERDA-tr-1, pp 111-115) ROLE OF ENDOGENOUS LOW-MOLECULAR-WEIGHT PHENOLIC METABOLITES IN RADIATION INHIBITION OF OXIDATIVE PHOSPHORYLATION. Kopylov, V. A.; Dovgii, I. E.; Kutsyi, M. P. (Inst. of Biological Physics, Pushchino, USSR). May 1975. Translated from Radiobiologiya; 14: No. 5, 736-739(1974).

In radiobiology.

The role of certain natural regulators (endogenous low-molecular-weight phenolic metabolites of oxidative phosphorylation (OP) on the disruption of OP in irradiated rats was studied. On the basis of the data obtained, it seems possible to suggest that the change in the concentration of certain natural regulators of OP in the case of irradiation of animals is one of the causes of the disruption of the process of coupled OP under the action of ionizing radiation. (ERB)

6625 (ERDA-tr-1, pp 116-118) ACTIVITY OF ACID PHOSPHATASE (TOTAL AND FREE) IN PROLONGED IRRADIATION. Bicheikina, N. I.; Romantsev, E. F. May 1975. Translated from Radiobiologiya; 14: No. 5, 740-742(1974).

In radiobiology.

The total and free activity of acid phosphatase in the liver, brain, and spleen of rats during prolonged irradiation (1100 R at 48 R/hr) was determined. It was concluded from the experiment that no significant difference was revealed in the post-radiation change in the activity of acid phosphatase in the investigated rat organs. (ERB)

6626 EFFECTS OF GAMMA RADIATION ON THE OPTICAL PROPERTIES OF AQUEOUS LYSOZYME-POLYINOSINIC-ACID COMPLEXES. Dave, Y.; Trumbore, C. N. (Univ. of Delaware, Newark). Int. J. Radiat. Biol.; 27: No. 1, 31-39(Jan 1975).

The absorption of gamma rays by dilute aqueous solutions of lysozyme and polyinosinic acid (poly I) caused significant increases in the light-scattering power of room temperature solutions in certain critical concentration regions. Light-scattering properties were unaltered by relatively large doses of radiation delivered to heated complexes. Prior irradiation of the poly I alone yielded complexes whose light-scattering properties were the same as those of the unirradiated system. Studies of the radiation-induced absorbance changes of these complexes at 260 and 280 nm showed behavior indicative of the radiation chemistry of polynucleotide rather than of lysozyme. From the evidence available, it was postulated that most of the damage was to the poly I rather than lysozyme in the complexes. Increases in light-scattering and dissymmetry were attributed to unwinding of the multi-stranded polynucleotide. The role of water in the formation and radiation sensitivity of the complexes is discussed. (auth)

6627 BIOLOGICAL RELEVANCE OF ALKALI-LABILE SITES IN DOUBLE-STRANDED DNA AFTER γ IRRADIATION. Luecke-Huhle, C. (Kernforschungszentrum, Karlsruhe, Ger.). Int. J. Radiat. Biol.; 27: No. 1, 1-6(Jan 1975).

Alkali-labile sites produced by γ irradiation in dry RF-DNA of bacteriophage ϕX 174 were found to be lethal lesions with respect to the plaque-forming ability. (auth)

6628 EFFECTS OF DRYING ON DEOXYRIBONUCLEIC ACIDS. Ando, Y. (Gakushuin Univ., Tokyo (Japan). Faculty of Science); Fukada, E. J. Radiat. Res.; 15: No. 4, 12-218(Dec 1974).

Effects of drying, a frequently used storage condition, on various physicochemical characteristics of DNA has been examined in DNA solution prepared from dried-DNA and original, native DNA. Drying resulted in a decrease of viscosity, a decrease of flow birefringence, a decreased sedimentation in neutral sucrose gradient, and little change in melting temperature of DNA. They imply that the drying caused a reduction of molecular weight and molecular size by 10 to 20 percent with little alteration in double strand character. Gamma irradiation of DNA solution prepared from native and dried DNA showed a remarkable difference in their responses to radiation. Thirty krads of gamma rays caused dried-DNA to decrease its molecular weight by 70 percent and its melting temperature by 26°C, while it caused native-DNA to decrease its molecular weight by 10 percent and its temperature by 10°C. The apparent efficiency of double-strand scission of dried-DNA was 20 eV per one scission, and that of native DNA was 200 eV. The increased radiosensitivity of dried DNA might be resulted from formation of hidden damages through drying. These results implied that the commonly used storage condition, drying, is not suitable for radiation and other studies. (auth)

6629 LET DEPENDENCE OF DNA SINGLE-STRAND SCISSION IN E. COLI B_{s-1} BY CHARGED PARTICLES. Igarashi, K.; Yatagai, F.; Takahashi, T.; Matsuyama, A. (Institute of Physical and Chemical Research, Wako, Saitama (Japan)). J. Radiat. Res.; 15: No. 3, 148-155(Sep 1974).

Log-phase cells of E. coli B_{s-1} labelled with ^{3}H-thymidine were bombarded with α-particles, carbon- and nitrogen-ions of various energies and the LET dependence of the efficiency of DNA single-strand break production (E_{sb}) was investigated. The amounts of radiation energy required for single-strand break production proportionally increased with increasing LET_∞ in the range greater than about 90 keV $\cdot$ μm^{-1}. The heavier particle gave an $LET_\infty \cdot E_{sb}$ curve shifted to the higher LET as compared with that for the lighter particle. The relationship between the restricted LET (LET_{500}) and E_{sb} corrected for γ-rays was represented by the same linear regression curve for the above three kinds of particles. Analysis of the high-LET data in correlation with survival radiosensitivity indicated that the number of particles passed through the DNA strand per D_{37} decreases with increasing LET, approaching to the unity and the number of single-strand breaks per D_{37} produced by the track-core effect decreases toward a value of about three. The results suggest that the traversal of a heavy charged particle of high LET through the DNA strand may produce a double-strand break, which would be of major importance in cell inactivation at high LET, but single-strand breaks produced mainly by γ-rays is not necessarily lethal. (auth)

6630 PRIMARY STATE OF DNA AS A MATRIX IN DNA-POLYMERASE REACTION IN γ-IRRADIATED CELLS OF E. COLI. Gaziev, A. I.; Kuzin, A. M. (Inst. of Biological Physics, Pushchino-on-Oke, USSR). Dokl. Akad. Nauk SSSR; 218: No. 5, 1214-1217(11 Oct 1974). (In Russian).

The capacity of DNA-polymerase I to use DNA from γ-irradiated E. coli cells as a matrix in the polymerase reaction was studied and the state of the 3'OH end group of the radioinduced breaks in this DNA was analyzed. The data obtained indicate that the 3'OH end groups of the unifilar break in the DNA, induced directly by radiation-chemical reactions without participation of endonuclease, have in vivo different substrate states. About 70% of the 3'OH end groups are specific to the DNA-polymerase and of them 50 to 55% are bound by ligases during phosphorylation of the free 5'OH end of the PN-kinases. Obviously for reparation of part of the unifilar breaks (~30 %) with participation of DNA-polymerase, the preliminary effect of exonuclease III is required since the 3' → 5'-exonuclease subunit of the DNA-polymerase I can not activate the $3'PO_4$ end. (JSR)

6631 EARLY AND ENHANCED ANTITOXIN RESPONSES ELICITED WITH COMPLEXES OF TETANUS TOXOID AND SPECIFIC MOUSE AND HUMAN ANTIBODIES. Stoner, R. D.; Terres, G.; Hess, M. W. (Brookhaven National Lab., Upton, NY). J. Infect. Dis.; 131: No. 3, 230-238(Mar 1975).

Primary tetanus antitoxin responses were early and enhanced in mice when tetanus toxoid was administered in complex with specific isologous antitoxin or specific mouse gamma-globulin. Antitoxin responses were enhanced when fluid tetanus toxoid was complexed in vitro in antigen-to-antibody ratios of equivalence or antigen excess; responses to complexed toxoid in antibody excess were comparatively repressed. Primary responses were greatly exhibited in mice immunized with the same amount of toxoid complexed at equivalence or in antibody excess with specific human gamma-globulin. Although primary responses were totally repressed, a primed state developed; a second injection of fluid toxoid within a few days produced excellent antitoxin responses. Separate injections of antigen and antibody at different sites produced an excellent in vivo primed state for early and high responses. Antibody production after stimulation with complexed toxoid was also enhanced in mice irradiated with 400 rads, a dose that ordinarily completely suppresses primary responses with fluid toxoid alone. These data provide evidence for the efficacy of antigen-antibody complexes in early and active immunization. (auth)

6632 NONRANDOM DISTRIBUTION OF DNA STRUCTURAL DISTURBANCES DURING GAMMA IRRADIATION IN VITRO. Todorov, I. N.; Shugalii, A. V.; Fonarev, A. B. (Inst. of Molecular Biological Genetics, Kiev). Dokl. Akad. Nauk SSSR; 220: No. 5, 1226-1229(11 Feb 1975). (In Russian).

The purpose of this study was to investigate the character of the defect distribution in the primary and secondary structure of DNA fractions differing in average guanidine-cytosine composition and also in repeating sequences. Thymus calf DNA was fractionated by melting on a hydroxapatite column. The higher-melting DNA fractions had a higher guanidine-cytosine content. After gamma irradiation it was found that the number of defects decreases with increasing guanidine-cytosine content. Thus if a preparation of DNA contains 11% damaged hydrogen bonds and 8.7% base loss, these figures are 5.2% and 4.4% respectively in the DNA fraction rich in guanidine and cytosine. It is concluded that the main damage to the DNA molecule is concentrated in fractions rich in adenine and thymine. A statistical reliable correlation was found between the relative content of pyridimine base in DNA and the radiosensitivity of the organisms. (SJR)

6633 PHOTOINDUCED COVALENT CROSSLINKAGE, IN SITU, OF ESCHERICHIA COLI 50 S RIBOSOMAL PROTEINS TO RNA. Gorelic, L. (Wayne State Univ., Detroit). Biochim. Biophys. Acta; 390: No. 2, 209-225(May 1975).

Irradiation of aqueous solutions of Escherichia coli 50 S ribosomal subunits with 253.7 nm light results in the covalent crosslinkage of the rRNA and protein components. Neither peptide bond cleavage nor protein-protein crosslinkage accompanies the crosslinkage reaction. In addition, substantial photoinduced modifications in the primary structure of the ribosomal proteins, other than crosslinkage to rRNA, are not detected. The crosslinkage of the ribosomal proteins to the rRNA proceeds in two discrete, dose-dependent steps. The first step requires an input of up to 3×10^{20} quanta of 253.7 nm radiation and results in the crosslinkage of less than half of the ribosomal proteins to the rRNA. The second step requires an input of greater than 3×10^{20} quanta of 253.7 nm radiation, and results in the crosslinkage of the remaining ribosomal proteins to the rRNA. The possible relationship of the nature of the crosslinkage reaction to the spatial orientations of the rRNA and protein molecules in the intact 50 S ribosomal subunits is discussed. (NL)

6634 X-RAY EFFECT ON ELECTROPLAX ACETYLCHOLINESTERASE: PROTECTION BY CYSTEAMINE. Hasson-Voloch, A.; Somlo, C.; Elias, C. A.; Santos, M. N. E. (Univ. of Federal, Rio de Janeiro). An. Acad. Bras. Cienc.; 45: No. 3/4, 621-628(1973).

The effect of x rays on acetylcholinesterase has been examined in crude extracts and purified fractions from the electroplax of the electric organ of Electrophorus electricus (L). Electroplax extracts at high ionic strength contain several fractions with acetylcholinesterase activity which are separable by cellulose ion exchange chromatography. The dose inactivation curves of the enzyme fractions are consistent with the idea that the more acidic fractions eluted from an anion exchanger have two components of different radiosensitivities. On account of its anionic properties the resistant component could be separated from an irradiated crude extract submitted to ion exchange chromatography. These results are in agreement with previous findings obtained with non purified acetylcholinesterase irradiated with γ rays. Protection by cysteamine was investigated and it is shown that for a dose of 800 krads the radiation effects diminish as the concentration of cysteamine is increased from 12 mM to 0.12 M where the original enzyme activity is maintained. (auth)

Radiation Effects on Cells

Refer also to abstracts 6717, 6758, and 6785.

6635 (ERDA-tr-1, pp 6-10) REPAIR OF SINGLE-STRANDED BREAKS IN DNA OF MAMMALIAN CELLS AFTER THE ACTION OF X RAYS AND ALPHA IRRADIATION. Cechacek, Z.; Drasil, V. (Inst. of Biophysics, Brno). May 1975. Translated from Radiobiologiya; 14: No. 5, 647-650(1974).

In radiobiology.

A comparative investigation was made of the formation of single breaks in DNA in a culture of mammalian L cells under the action of comparable doses of x rays and α rays (with a high LET). The repair of the breaks formed was also investigated as a function of the temperature. After lysis of the cells and differential centrifugation in a sucrose gradient of DNA labeled in vivo, it was established that the molecules of free DNA sediment independently of one another. In a study of the origin and repair of simple breaks, substantial differences were determined between x irradiation and α irradiation. Under the influence of α irradiation with a LET greater than 100 keV/μ, substantially fewer breaks arise in DNA than under the action of x irradiation. The repair of breaks also occurs differently. (tr-auth)

6636 (GSF-B-553) THE PROLIFERATION PATTERN OF NONIRRADIATED AND X-IRRADIATED MAMMALIAN CELLS IN VITRO. Time-Lapse Microkinematographic Studies. Trott, K. R. (Muenchen Univ. (F. R. Germany). Medizinische Fakultaet). Jul 1974. 179p. (In German). INIS.

28 figs.; 5 tabs.; 94 refs.

Putting up and analyzing the genealogical tree of non-irradiated and x-irradiated cells is reported. Various parameters of proliferation, normal or disturbed by irradiation, and their mutual relation are elaborated from these data. (GE)

6637 (NIRS-R-2, pp 44-47) RADIOSENSITIVITY OF VARIOUS CELLS IN VIVO UNDER HYPOXIC CONDITION. Inada, T.; Furuse, T.; Hiraoka, T.; Takahashi, I.; Kasuga, T. Nov 1973. (In Japanese).

In first report on the cancer therapy with high energy particles and the utilization of short lived radionuclides in diagnostics. (National Inst. of Radiological Sciences, Chiba (Japan)).

In order to confirm the radiosensitivity of various culture cells quantitatively under hypoxic condition with high reproducibility, the electrode for the measurement of oxygen concentration was prepared and improved. The culture cells were then deoxygenized by the combined use of evacuation, and the following results were obtained. As the Pt:Ag/AgCl electrode was put into an injectable needle-like detector, the sensitivity was high and the reproducibility of the response was good. In the deoxygenation method, the oxygen in the culture solution and the oxygen absorbed in the content were exchanged for nitrogen and were removed by several times of evacuations and repeated N_2 gas flow. As the procedure was completed within 30 minutes, no decrease in plating efficiency was found. X-ray sensitivity was almost the same in 4 kinds of culture cells (HeLa-S_3, 2 melanomas in mice and 1 melanoma in man) in the oxygen with the concentration of 0.25 ppM. (JA)

6638 (NIRS-R-2, pp 49-53) BIOLOGICAL EFFECT OF FAST NEUTRONS ON FURTH'S MASTOCYTOMA CELL. Nakamura, W.; Inada, T.; Nishimoto, Y. Nov 1973. (In Japanese).

In first report on the cancer therapy with high energy particles and the utilization of short lived radionuclides in diagnostics. (National Inst. of Radiological Sciences, Chiba (Japan)).

The response to neutron irradiation in vitro of Furth's mastocytoma cells containing a large quantity of serotonin, which is regarded as an endogenous protective substance under conditions of in vivo experiments using mice, is discussed. It was recognized from the measurement of the excreted amount and the number of cells that 5-hydroxyindoleacetic acid in urine was best suited for an index indicating the number of the cells that proliferated in the peritoneum. RBE of 2-MeV neutrons showed 3.7 under non-shaking condition at room temperature. OER was obtained from the experiment x-irradiated at room temperature, shaking of the container, and saturating with O_2 air, and N_2 gas on the occasion of in vitro irradiation was 2.6, and RBE ($D\ 10^{-2}$ of 2 MeV neutron was 5.5. (JA)

6639 (NIRS-R-2, pp 53-56) RELATIVE BIOLOGICAL EFFECT OF FAST NEUTRONS AND X-RAYS ON A MURINE TUMOR. Urano, M.; Ando, K.; Koike, Y. Nov 1973. (In Japanese).

In first report on the cancer therapy with high energy particles and the utilization of short lived radionuclides in diagnostics. (National Inst. of Radiological Sciences, Chiba (Japan)).

Responses of murine breast cancer and melanoma to fast neutrons and x rays were compared and discussed. Relationship between tumors and irradiation was observed for 150 days after irradiation on condition that TSD of x-ray irradiation was 15 cm and dose rate of x-rays or fast neutrons was 650 rads/min and 7 rads/min, respectively. With respect to relationship between radiation dose and survival probability of the cells in murine breast cancer on hypoxic condition, x-ray irradiation showed m of 5.5 and Do of 380 rads, and fast neutrons irradiation showed m of 1.06 and Do of 135 rads. On aerobic condition, x-ray irradiation showed m of 5.5 and Do of 130 rads, and fast neutrons irradiation showed m of 1.06 and Do of 80 rads. TCD 50 of x-ray and fast-neutron irradiation at two days after tumor transplantation was 2175 rads and 600 rads, respectively, and RBE at that time was 3.6. Difference between the radiation property at recurrence time was not recognized. RBE calculated from difference between single x-ray irradiation and mixture of x-ray and fast-neutron irradiation under aerobic conditions was 4.4 to 4.5. TCD 50 of x-ray and fast neutron irradiation at two days after melanoma transplantation was 2050 rads and 500 rads, respectively, and RBE was 4.1. Difference of recurrence time was not recognized. (JA)

6640 PROTECTIVE EFFECT OF SH COMPOUNDS ON THE RADIATION INDUCED MITOTIC DELAY. I. Protection by Glutathione. Kawasaki, S.; Kobayashi, M.; Okita, I.; Suetomi, K.; Sakurai, K. (Yamaguchi Univ., Ube (Japan). School of Medicine). Nippon Igaku Hoshasen Gakkai Zasshi; 34: No. 6, 444-448(Jun 1974). (In Japanese).

Protective effect of glutathione at 5 and 20 mM on radiation-induced mitotic delay in cultured L-5 cells was studied. When the dose-response curve of mitotic delay was plotted on a log-arithmic scale, the curve was linear. The groups treated with glutathione during irradiation of 100 and 200 rads showed a faster recovery of the mitotic index than the control irradiated without chemical treatment. The recovery rate of mitotic index after x irradiation was facilitated by treatment with glutathione during irradiation of 100 and 200 rads, but glutathione had no effect on the mitotic delay time. The effect of glutathione became greater by increasing concentration of glutathione. On the basis of these data, the mechanisms of the radioprotective action of glutathione were discussed. (auth)

6641 RADIOSENSITIVITY OF HYPOXIC HeLa S_3 CELLS IN VITRO. Ohara, H.; Inada, T. (National Inst. of Radiological Sciences, Chiba (Japan)). J. Radiat. Res.; 15: No. 3, 127-131 (Sep 1974).

The HeLa S_3 cells were placed in the hypoxic condition by repeating the evacuation-and-N_2-flushing step in a small irradiation box. The oxygen concentration in the culture medium was, then, estimated at every step of the gas exchange process and was reduced to as low as 7.0 μmoles $litre^{-1}$ (about 5,300 volume or 0.225 weight ppm) within 30 minutes. The dose survival curves under various hypoxic conditions showed that, with increasing the degree of hypoxia, the Do was increased and the extrapolation number (n) was reduced. (auth)

6642 RADIOSENSITIVITY OF T AND B LYMPHOCYTES. P. 2. Effect of Irradiation on Response of T Cells to Alloantigens. Sprent, J. (Basel Univ. (Switzerland). Inst. fuer Immunologie); Anderson, R. E. (New Mexico Univ., Albuquerque (USA). Dept. of Pathology); Miller, J. F. A. P. (Walter and Eliza Hall Inst. of Medical Research, Parkville (Australia)). Eur. J. Immunol.; 4: No. 3, 204-210(Mar 1974).

The radiosensitivity of T cells was investigated by studying the effect of irradiation in vitro in suppressing the capacity of parental strain thoracic duct lymphocytes (a) to induce splenomegaly in newborn F_1 mice, and (b) to proliferate in adult irradiated F_1 mice as measured by incorporation of tritiated thymidine ([^{3}H]dThd) 4 days after transfer. By these parameters, small T lymphocytes were found to be highly radiosensitive. It was calculated that, of cells with the reactivity to the alloantigens studied, 0.3% were capable of a proliferative response after exposure to 500 r. Radiosensitivity was considered to be a reflection of lymphocyte death in interphase. The radiosensitivity of H-2-activated T cells (T.TDL) differed from that of small T cells. Thus, [^{3}H]dThd incorporation by T.TDL measured 1 day after transfer to irradiated F_1 hosts was not abolished, although lowered, by exposure to doses as high as 5000 r; [^{3}H]dThd incorporation measured at 2 days, however, was greatly reduced by much smaller doses of irradiation. In view of evidence obtained elsewhere that the response of T.TDL to alloanitgens involves DNA synthesis but not cell division, the present studies were interpreted in terms of irradiation causing death of T.TDL in interphase before entry into DNA synthesis. It was concluded that T.TDL were far more resistant to irradiation-induced interphase death than were small T cells. The small numbers of lymphocytes obtained from thoracic duct lymph of mice exposed to whole body irradiation 4 days before consisted almost entirely of T cells; these cells, although viable, were found incapable of mounting a proliferate response when exposed to alloantigens on transfer. (auth)

Radiation Effects on Microorganisms

Refer also to abstracts 6465, 6627, 6629, 6630, and 6717.

6643 (ERDA-tr-1, pp 47-52) PRINCIPLES OF THE FORMATION OF RADIORACES IN YEAST ORGANISMS. Communication 7. Estimation of the Frequency of Mitotic Recombination in Clones Growing from Irradiated Cells. Korogodin, V. I.; Bliznik, K. M.; Kapul'tsevich, Yu. G. (Scientific Research Inst. of Medical Radiology, Obninsk, USSR). May 1975. Translated from Radiobiologiya; 14: No. 5, 681-685(1974).

In radiobiology.

The objects of investigation were diploid yeasts Saccharomyces cerevisiae, a strain heterozygous with respect to the genes ade 1 and ade 2. The curve of the survival of these yeasts under the action of the γ rays of ^{60}Co is sigmoid. The colonies growing out of irradiated cells vary widely in size and form. The frequency of mitotic recombination was estimated according to the yield of red colonies and colonies with red sectors; this frequency increased with the dose of irradiation, and the yield of red colonies increased more rapidly than the sector colonies. At a dose of 30 krad (survival equal to approximately 75%), the content of recombinant colonies was nonuniformly distributed among the primary colonies of different classes: their minimum number was encountered among the colonies giving rise to stable clones, and the maximum number among the colonies that usually gave rise to unstable clones. The frequency of mitotic recombination in the unstable clones proved to be approximately seven times as high as in the stable clones. It is suggested that in radiation race formation in diploid yeasts, a significant role is played by the increased frequency of mitotic recombination. (tr-auth)

6644 (ORO-3408-22) PROGRESS REPORT AND RENEWAL REQUEST FOR PERIOD AUGUST 15, 1975–AUGUST 14, 1976. Powers, E. L. (Texas Univ., Austin (USA). Dept. of Zoology). May 1975. Contract AT(40-1)-3408, 13p. Dep. NTIS $4.00.

Progress is reported on studies on the effects of x radiation on the photosynthetic activity of a blue-green algae and reproductive ability of Chlorella; the effects of benzyl alcohols, t-butanol, and peroxy radicals on the radiosensitivity of spores of Bacillus megatherium; and chemical mechanisms for the induction of mutations in B. megatherium spores. (CH)

6645 EFFECTS OF MILD HEATING ON RECOVERY FROM ULTRAVIOLET INACTIVATION IN ESCHERICHIA COLI B/r. I. Inhibition of Excision of Pyrimidine Dimers. Okuda, A. (Tottori Univ., Yonago (Japan). School of Medicine). J. Radiat. Res.; 15: No. 3, 132-139(Sep 1974).

Mild heating (52°C for 20 min) of stationary phase cells of E. coli B/r starved for 2 hr caused little killing effect (80% survival) but induced division delay (2.5 hr). When heat and uv (750 erg mm^{-2})-treated cells were incubated in growth medium, extensive lag phase (6 hr) in cultural response and prolonged period (4 hr) susceptible to constant level of photoreactivation were observed. Liquid holding recovery was inhibited by pre-uv heat treatment. Pyrimidine dimers in heat and uv-treated cells were not excised during 4 hr of post-incubation in growth medium. After prolonged incubation, dimer excision resumed, although the rate was much

slower than in the cells treated with uv alone. It is concluded that inhibition of dimer excision plays an important role in the observed heat effects; uv sensitization, prolongation of the period susceptible to photoreactivation, and inhibition of liquid holding recovery. (auth)

6646 EFFECTS OF MILD HEATING ON RECOVERY FROM ULTRAVIOLET INACTIVATION IN ESCHERICHIA COLI B/r. II. Removal of Heat-Induced Effects by Subsequent Incubation. Okuda, A. (Tottori Univ., Yonago (Japan). School of Medicine). J. Radiat. Res.; 15: No. 3, 140-143(Sep 1974).

When heat (52°C for 20 min) and ultraviolet (uv, 750 erg mm^{-2}) treated E. coli B/r cells were subjected to liquid holding and then illuminated with photoreactivating light, their ability to be photoreactivated (photoreactivability) was not changed during 30 hr holding. However, when heat-treated cells were incubated in growth medium for 3 hr, exposed to uv, and then subjected to liquid holding for 6 hr, photoreactivability disappeared completely. Such disappearance of photoreactivability was also observed when heat treated cells were incubated in growth medium before uv exposure in the presence of hydroxyurea or chloramphenicol, but not when incubated in buffer. These results suggest that heat-induced lesions, which inhibit dimer excision, are repaired during incubation in growth medium. (auth)

6647 EFFECTS OF IONIZING RADIATION ON RECOVERY FROM ULTRAVIOLET INACTIVATION IN ESCHERICHIA COLI B/r. Okuda, A. (Tottori Univ., Yonago (Japan). School of Medicine). J. Radiat. Res.; 15: No. 3, 144-147(Sep 1974).

When ultraviolet (uv)-irradiated E. coli B/r cells were subjected to liquid holding and then irradiated with high energy electrons, the survival increased with the holding time. On the other hand, such an increase in survival was not observed when uv plus electron-irradiated cells were subjected to liquid holding. When photoreactivating light was further illuminated after these treatments, photoreactivating effect was completely lost within 3 hr of liquid holding in the former case, but was observed significantly after 3 hr of liquid holding in the latter case. When liquid holding was performed in the presence of caffeine, such an increase in survival and such a loss of photoreactivating effect were inhibited. They suggest that synergistic killing action of uv and ionizing radiations is partially caused by inhibition of excision-repair mechanism. (auth)

6648 PRODUCTION OF THE STREPTOMYCINRESISTANT MUTANTS OF AUXOTROPHIC STRAINS OF SOME MICROORGANISMS BY VARIOUS MUTAGENS. Gubanova, L. L.; Nosikova, T. A. (Biological Inst., Novosibirsk, USSR). Izv. Sib. Otd. Akad. Nauk SSSR, Ser. Biol. Nauk; No. 15, 90-94(Dec 1974). (In Russian).

The mutants Azotobacter suis H_{70} tyr and Escherichia coli II24 lys^- resistant to 50 to 100 units ml streptomycin were obtained using uv-rays and nitroso ethyl urea. The mutants of these strains resistant to 10,000 to 50,000 units ml streptomycin were obtained using 5-bromouracil. The strain E. coli II24 str^r may be used for quantitative determination of lysine in unsterile conditions. The strain Azotobacter suis H_{70} str^r may be used for the fermentation of tryptophan in unsterile conditions. (auth)

6649 INDUCTION OF PROPHAGE BY ULTRA-VIOLET LIGHT IN A THERMOSENSITIVE MUTANT OF ESCHERICHIA COLI K12 (λ). Chermont, M. C.; de Almeida, D. F. (Univ. of Federal, Rio de Janeiro). An. Acad. Bras. Cienc.; 45: No. 3/4, 413-418(1973). (In Portuguese).

A temperature-sensitive mutant (R6) has been obtained from E. coli K12 C600 (λ) by treatment with N-methyl-N'-nitro-N-nitrosoguanidine. Its optimal temperature for growth is found around 34°C; at 42°C, the mutant lyses within 40 minutes while keeping phage titers at background level (around $5 \cdot 10^8$ p.f.u./ml). At permissive temperatures (30 to 34°C) phage induction of R6 by uv irradiation leads to a delay in the occurrence of lysis, which only takes place after 90 minutes; phage titers raise to figures which are still 50 to 100× lower than those found with the parental strain. Ultraviolet induction followed by incubation at 42°C delays lysis similarly, but phage titers are as high as with the induced parental strain (around $2 \cdot 10^9$ p.f.u./ml). The later the incubation at non-permissive temperatures is initiated after induction, the lower will be the phage titer obtained. Synthesis of plaque-forming particles proceeds during the time for which lysis is delayed after uv irradiation. (auth)

6650 SENSITIVITY TO ^{60}Co GAMMA RAYS OF A SERIES OF STRAINS OF SACCHAROMYCES CEREVISIAE CARRYING DIFFERENT MUTATIONS. I. Radiosensitivity of Haploid Strains. Sokurova, E. N. (Inst. of Medical Radiology, Obninsk, USSR). Genetika; 11: No. 3, 122-126(Mar 1975). (In Russian).

Sensitivity to ^{60}Co gamma rays of haploid strains of Saccharomyces cerevisiae carrying ade_{1-6} mutations and dominant, semidominant, and recessive suppressors was investigated. It was shown that three out of four studied strains with ade_{1-6} mutation had reliable increased radioresistance. The increased radioresistance was observed also in strains carrying, beside ade_{1-6} mutation, dominant and semidominant suppressors. However the strain carrying a recessive suppressive mutation turned out to be radiosensitive. A conclusion is drawn that radiosensitivity of yeast cells can be influenced by different mutations affecting the process of cell metabolism. (auth)

Radiation Effects on Plants

Refer also to abstracts 6623, 6644, and 6717.

6651 (ERDA-tr-1, pp 22-26) TRANSPORT OF CALCIUM IONS IN THE MITOCHONDRIA OF PEA SEEDLINGS IN THE CASE OF X IRRADIATION IN VIVO AND IN VITRO. Kalacheva, V. Ya.; Pavlovskaya, T. E.; Akilova, N. A. (Inst. of Biochemistry, Moscow). May 1975. Translated from Radiobiologiya; 14: No. 5, 661-664(1974).

In radiobiology.

The action of x irradiation on the transport of Ca^{2+} ions in the mitochondria of pea seedlings was studied. It was shown that the nature of the changes and the quantitative principles in the irradiation of the mitochondria in vivo and in vitro were the same. A decrease in the effectiveness of ionic absorption was noted immediately after irradiation at doses of 5 and 10 kR. At all the doses studied (1, 5, and 10 kR), an increase in the loss of calcium ions from the mitochondria to the surrounding medium was noted. Approximately the same relative increase in the rate of loss of Ca^{2+} by the irradiated mitochondria at 0 and 25°C was evidence of the possible role of structural rearrangements in the mitochondrial membrane. (tr-auth)

6652 (ERDA-tr-1, pp 146-148) MODIFYING EFFECT OF CAFFEINE ON THE CYTOGENETIC EFFECT OF IRRADIATION OF CORN SEEDLINGS OF DIFFERENT RADIOSENSITIVITIES. Volodin, V. G.; Gordei, I. A. (Inst. of Genetics and Cytology, Minsk). May 1975. Translated from Radiobiologiya; 14: No. 5, 763-766(1974).

In radiobiology.

The influence of caffeine on the yield of chromosome aberrations in γ-irradiated corn seedlings differing in radioresistance was studied. On the basis of the data obtained, it can evidently be considered that in radioresistant forms, processes leading to the repair of radiation damages to the chromosomes proceed more intensively; therefore, the inhibitor (caffeine) is more effective in resistant forms than in the sensitive forms. (ERB)

6653 (ERDA-tr-1, pp 175-177) EFFECTS OF IONIZING RADIATIONS ON CERTAIN PHYSIOLOGICAL PROCESSES OF LICORICE. Abdrakhmanov, O. K.; Filippova, N. F.; Kryukova, L. M. (Inst. of Biological Physics, Pushchino, USSR). 1974. Translated from Radiobiologiya; 14: No. 5, 787-789(1974).

In radiobiology.

Ionizing radiation at doses of 100 and 500 R had a stimulating effect on the germination of seeds, stimulation of plant growth, and productivity. It is known that ionizing radiations in small doses stimulate processes of metabolism. In view of this, we were interested in problems of the uptake of ^{32}P and the change in the intensity of cell division in licorice plants grown from irradiated seeds. Radiostimulation of the growth and development of the plants is associated with an activation of cell division and a more intensive uptake of the substance. The latter effect is probably associated with a change in the permeability of the cell membranes under the influence of ionizing radiations. (ERB)

6654 PREDPOSEVNOE OBLUCHENIE SEMYAN SEL'SKOKHOZYAISTVENNYKH RASTENII. (Presowing Irradiation of Plant Seeds). Berezina, N. M.; Kaushanskii, D. A. Moscow; Atomizdat (1975). 264p.

This book generalizes the literature data and the results of particular studies on the presowing irradiation of plant seeds by gamma quanta. Theoretical bases are presented for the stimulating effect of small, irradiation doses, and mechanism of the effect. Evidence is presented for the possibility of increasing plant yield, accelerating plant ripening, and improving the quality of material grown from the irradiated seeds. Results are presented of field experiments, production tests, and the first-year use of presowing irradiation (1973). The second edition (1st edition issued in 1964) expands the information on radiation technique used to irradiate seeds under commercial conditions. (SJR)

6655 RADIOSENSITIVITY OF THE POTATO PLANT AS A FUNCTION OF THE DURATION OF HETEROTROPHIC FEEDING. Avakyan, V. A. Biol. Zh. Arm.; 27: No. 10, 57-63(Oct 1974). (In Russian).

A study was made of the effect of separating away the irradiated, mother tubers on the radiosensitivity of the potato plant. It is shown that cutting short the time of heterotrophic feeding of the plant from the irradiated, mother tubers decreases the depression effect, and does not have an effect on the radiation genetics. (SJR)

6656 MUTAGENIC EFFECT OF GAMMA RAYS IN SEEDS OF CREPIS CAPILLARIS L. Azatyan, R. A. Biol. Zh. Arm.; 27: No. 11, 52-56(Nov 1974). (In Russian).

On irradiating seeds of C. capillaris with gamma rays, the mutation levels increase by a factor of three on storage for 60 days. On gamma irradiation, long-lived potential changes occur that appear as chromosomal breaks after sprouting. (SJR)

6657 CYTOEMBRYOLOGICAL FEATURES OF THE DEVELOPMENT OF MICROSPORES AND MALE GAMETOPHYTE ON IRRADIATING TOBACCO SEEDS. Danielyan, A. Kh.; Karagezyan, A. S. (Erevan State Univ.). Biol. Zh. Arm.; 27: No. 11, 64-71(Nov 1974). (In Russian).

A study was made of the effect of irradiating seeds with various x-ray doses on the generative parts of the tobacco plant. Presowing irradiation of seeds causes a series of deviations in the development of microspores and the male gametophyte, whose number increases in correspondence with the irradiation dose. (SJR)

6658 COMBINED TREATMENT OF CREPIS CAPILLARIS CELLS WITH ETHYLENIMINE AND GAMMA RAYS AT DIFFERENT STAGES OF THE MITOTIC CYCLE. Sidorov, V. P.; Makedonov, G. P. (Research Inst. for Biological Testing of Chemicals, Moscow). Genetika; 10: No. 12, 26-35(Dec 1974). (In Russian).

The effect of the combined treatment of Crepis capillaris cells with ethylenimine and gamma rays at two successive stages of cell division is studied. The treatment with mutagens at the G_1 stage of the cell cycle resulted in the super-additive effect in diploid cells. Additive effect was observed after the repeated treatment of cells with gamma-rays at S and G_2 stages. The number of chromosome aberrations in tetraploid cells did not exceed the additive level in all the variants of the experiments. (auth)

6659 TWO TYPES OF PREMUTATION DAMAGES INDUCED BY GAMMA RAYS IN CHROMOSOMES OF DRY SEED EMBRYOS. Protopopova, E. M.; Bagrova, A. M.; Shapiro, N. I. (Inst. of Developmental Biology, Moscow). Genetika; 10: No. 12, 36-44 (Dec 1974). (In Russian).

The effect of oxygen and far-red on gamma-irradiated Crepis capillaris seeds was studied. It is shown that both factors, applied during postirradiation seeds hydration, increase the frequency of chromosome aberrations. This increase is due to the realization of potential chromosome damages in the presence of oxygen and far-red. Effects of far-red and oxygen were found to be independent. Thus, combined treatment of irradiated seeds resulted in the increase of chromosome aberration frequency, which value comprised the sum of increases caused by each single mutagen. It is shown that far-red effect is the same under both aerobic and anaerobic conditions. According to the data obtained, it is suggested that far-red and oxygen not only act independently, but they also reveal potential changes of chromosome, different in their nature. (auth)

6660 THE EXPERIMENTAL MUTAGENESIS. Marie, R. (Institut de Recherches Agronomiques Tropicales et des Cultures Vivrieres, 75- Paris (France)). Agron. Trop. (Paris); 29: No. 9, 892-900(1974). (In French).

The origin of the experimental mutagenesis and the hazardous character of the mutations are outlined and the main terms are defined. The work carried out on rice at Montpellier is described: the technique of treatment and location of the mutated plants, the difficulties, successes and failures. The mutations observed are of interest either from an agricultural point of view or for theoretical genetic study. Most mutations cannot be used directly because some of the characters associated with them are unfavorable and must be corrected. The concept of mutagene yield (number of good mutants) is explained and the possible use in other plants. (FR)

6661 X-RAY INDUCED MUTATIONS IN BEGONIA X HIEMALIS. Doorenbos, J.; Karper, J. J. (Landbouwhogeschool, Wageningen, Netherlands). Euphytica; 24: No. 1, 13-19(Feb 1975).

A study was made of the occurrence of mutants in plants of four clones of Begonia x hiemalis grown from leaf cuttings irradiated with x rays. Irradiation reduced the number and slowed down the development of adventitious shoots, but to a different degree in the four clones used. The percentage of mutated shoots was 18 to 35% in the non-irradiated shoots. Irradiation raised it to more than 80%. In the control plants, almost exclusively flower color mutants were found. Irradiation caused a wider range of flower color mutants and also caused mutations of growth habit, color and size of the leaves, and size and shape of the flower. Almost all mutants were solid, i.e., non-chimeral. (NL)

6662 EXAMINATIONS ON THE SPECIFIC EFFECT OF LOW DOSES OF IONIZING RADIATION ON THE SEED OF CULTIVATED PLANTS: 5-YEAR PRODUCTION EXPERIMENTS WITH SILO MAIZE SEED IRRADIATED WITH ^{60}Co-GAMMA RADIATION. Degner, W.; Schacht, W. (Humboldt-Univ., Berlin). Radiobiol. Radiother.; 16: No. 1, 37-49(1975). (In German).

Within 5 years, production experiments were carried out on a total area of about 2500 hectares in cooperation with agricultural production cooperatives and nationally-owned farms with eight kinds of silo maize on ^{60}Co-irradiated seed in order to check the reproducibility of the increased crops which could be obtained by energy doses of 50 rad and 200 rad on large production areas. The most extensive experiment was carried out in honor of the 8th Party Congress of the Socialist Unity Party of Germany in collaboration with 46 cooperatives and two radiological clinics of the GDR on more than 1900 hectares. On the whole, it could be established that under the given conditions of irradiation the charge of 50 rad is superior to the charge of 200 rad and on the average yields an increased crop of 12 to 15%. Without entering into the substances of contents it seems to be noticeable that the increased yield of the cob is to the increased yield of the remaining plant as 3.9:1. Our results were comparable also under unfavorable meteorological conditions. Generally it was shown that the better growth conditions are, the higher relative increased crop could be observed. (auth)

6663 PROCESS OF ADAPTATION AND EVOLUTION IN IRRADIATED SYNTHETIC POPULATIONS OF ARABIDOPSIS THALIANA. Report II. The Change of the Arithmetical Means of Quantitative Characters in M_2-M_5. Dishler, V. Ya.; Rashal, I. D. Latv. PSR Zinat. Akad. Vestis; No. 3, 44-50(1975). (In Russian).

In irradiated synthetic populations of A. thaliana, an intense process of directed natural selection was observed. At the end of a 6 to 8 generation interval after irradiation, the arithmetical mean of plant height, stalk length, and number of internodes exceed the level of development of such indices in plants of non-irradiated control population. After repeated irradiation a particularly intense process of directed selection takes place. Irradiation with fast neutrons at the dose of 10 krad had greater efficiency than that with 3.0 krad and the 30.0 krad of gamma rays. The change of the arithmetical mean for characteristics in the successive generations after irradiation was connected with the natural selection of mutant genotypes. (auth)

6664 COMBINED EFFECT OF ETHYLENIMINE AND IONIZING RADIATION WITH DIFFERENT LET. Avetisov, V. A.; Valeva, S. A. (Inst. of Chemical Physics, Moscow). Genetika; 11: No. 3, 12-20(Mar 1975). (In Russian).

Barley seeds were irradiated with gamma quanta or with fast neutrons and subsequently treated with ethylenimine at different concentrations. The inducing effect of mutagens was analyzed by means of plotting time-effect curves throughout all the first mitosis in the root-tips of seedlings developed from treated seeds. The mutagenic effect of the treatment was inferred from the frequency of chlorophyll mutations in the M_2 and from their spectrum. The data obtained show both the quantitative and the qualitative difference between the effects of the mutagenic treatment depending on the type of irradiation on the one hand, and, on the other hand, on the ethylenimine concentration. The treatment of gamma-irradiated seeds with ethylenimine solution at low concentrations results, as it were, in some kind of radioprotective effect. The additive aberration-inducing effect is observed when gamma-irradiated seeds are treated with ethylenimine solution at high concentrations, whereas in the case of ethylenimine treatment of seeds previously exposed to fast neutrons the effect is super-additive. A decrease of the aberration-inducing effect in the M_1 is followed by a decrease of the frequency of chlorophyll mutations in the M_2. Possible causes of the phenomena observed are discussed. It is assumed that the potential stage of the initiation of chromosomal mutations induced by ionizing radiation is modified by ethylenimine. (auth)

6665 CHARACTERISTIC FEATURES OF SPONTANEOUS AND RADIATION-INDUCED CHROMOSOME BREAKS. Lebedeva, L. I.; Chubykin, V. L. (Inst. of Cytology and Genetics, Novosibirsk, USSR). Genetika; 11: No. 3, 29-36(Mar 1975). (In Russian).

It is shown by the study of the location of acentric fragments of chromosomes at metaphase and anaphase in the root cells of pea (cultivar Capital), in the cornea of rats (strain Wistar), in the bone marrow of mice (strain BALB), in the cultures of embryonic fibroblasts of mice (strain C_{57}Bl), and of embryonic human fibro-

blasts that some fragments are situated outside the equatorial plates, while others are situated within the plane of the equatorial plate. The fragments of the first type initiate mainly spontaneously, while the fragments of the second type are mainly induced by irradiation. These principles are observed in all the types of animal and plant cells studied. The location of the fragments observed in non-radiated cells could be explained if it be assumed, that all the chromosome breaks are realized before the prometaphase and by the beginning of the prometaphase the fragments are randomly distributed within the volume of the nucleus. At the prometaphase most fragments move from the equator to the pole of the cell and thus at the metaphase and anaphase are found to be located outside the equatorial plate. For the explanation of the observed ratio of the two types of fragments in an irradiated cell it is assumed that chromosome fragments resulting from breaks induced by irradiation are completely detached from chromosomes only after the beginning of the prometaphase. Possibly, the process of development of breaks is also not yet completed by this time, it continues and is completed at the metaphase, partially, at the anaphase of the mitosis. (auth)

Radiation Effects on Animals

Man

Refer also to abstracts 6406, 6592, 6640, 6642, 6793, 6794, 6927, 7869, 7872, 7886, and 8420.

6666 (AWRE-Trans-67) EMP EFFECTS ON MANKIND. Wik, M. (Foersvarets Forskningsanstalt, Stockholm (Sweden)). Apr. 1975. Translation by F. E. Wallwork and D. R. Quested of FOA-4-A-4500-29. 12p. Dep. NTIS (US Sales Only) $4.00. UK 50 pence.

The effects of electromagnetic pulses (EMP) on humans are very much a problem of secondary importance in the context of nuclear explosions. This report is intended to present a basis for the evaluation of EMP effects on man in those cases where such effects can, if at all, be contemplated. The report deals with conceivable causes of the effects, electric shock and protection against the effects of EMP on man. (auth)

6667 (CONF-750331-1) IMAGE QUALITY AND PATIENT EXPOSURE IN MAMMOGRAPHY, TOMOGRAPHY, ANGIOGRAPHY, AND BONE RADIOGRAPHY. Haus, A. G.; Rossmann, K.; Doi, K.; Chiles, J. T. (Chicago Univ., Ill. (USA). Dept. of Radiology; Franklin McLean Memorial Research Inst., Chicago, Ill. (USA)). 1975. 14p. (SM-193/41). Dep. NTIS $4.00.

From international symposium on advances in biomedical dosimetry; Vienna, Austria (10 Mar 1975).

In diagnostic radiology, the physical factors affecting image quality and patient exposure are complex and must be studied for each individual procedure. They are a function of recording system unsharpness, geometric unsharpness, image noise, and of the shape, size, and absorption properties of the anatomic part radiographed and the lesion to be detected. The choice of recording system has a significant effect on image quality, and the speed of the recording system is directly related to patient exposure for each procedure. In this presentation, the complexities involved in the selection of recording systems for four radiologic procedures are discussed. We describe in detail our most recent work on mammography with the Lo-Dose system, whereby a significant reduction in exposure may not reduce, but may even increase the diagnostic accuracy by reducing geometric unsharpness. We also describe several examples: (a) in tomography, image resolution is not decreased and diagnostic certainty is affected by a change from a medium-speed screen to a high-speed screen recording system (patient exposure is reduced by a factor of 2); (b) in fine-detail skeletal radiography, the diagnostic information is increased significantly by a change from a conventional screen-film technique to a non-screen technique with fine-grain film and optical magnification, but at the cost of increased patient exposure; and (c) in cerebral angiography, diagnostic information can be increased by use of a screen-film recording system of higher resolution, but lower speed for imaging of small blood vessels. Modulation Transfer Functions and clinical examples are used to illustrate each procedure. (auth)

6668 (ERDA-tr-1, pp 70-74) REPAIR OF RADIATION LESION OF MAMMALS DURING AND AFTER IRRADIATION. Tyazhelova, V. G.; Akoev, I. G. (Inst. of Biological Physics, Pushchino, USSR). May 1975. Translated from Radiobiologiya; 14: No. 5, 700-704(1974).

In radiobiology.

On the basis of an analysis of the experimental data and their theoretical generalization, dependences on the dose rate and duration of irradiation were obtained for the half-recovery period during a radiation influence for a number of mammals: mouse, rat, dog, man. Their relationship to the postradiation rate of recovery is discussed. It is suggested that the rate of repair depends on the change in the amount of radiation damage with time, which permits the process of formation of a lesion during and after irradiation to be described by a single kinetic model. (auth)

6669 (NIRS-R-2, pp 69-72) CHROMOSOME ABERRATIONS IN PERIPHERAL LYMPHOCYTES OF CANCER PATIENTS RECEIVING NEUTRON THERAPY. Ishihara, T.; Kohno, S.; Inaba, M.; Tsunemoto, H. Nov 1973. (In Japanese).

In first report on the cancer therapy with high energy particles and the utilization of short lived radionuclides in diagnostics. (National Inst. of Radiological Sciences, Chiba (Japan)).

Radioinduced chromosome aberrations in the peripheral blood lymphocytes of the patients with malignant tumor who had received treatment with Van de Graaff fast neutron were analyzed. The relationship between time after irradiation and occurrence of chromosome aberration, the relationship between the occurrence of chromosome aberration and irradiation doses and RBE value of fast neutron were studied. In addition, the stage of blood that should be used after neutron irradiation was studied. As a result, the occurrence of chromosome aberration was maintained at almost a constant rate, i.e., 1-48 hours. RBE was obtained by the occurrence of chromosome aberration. RBE values were suggested from the occurrence rates of chromosome aberration (dicentrics + rings) in the patients having x-ray irradiation under the almost same condition as fast neutrons. These values were 4.36 and 5.61. The effects of neutron upon the peripheral blood lymphocytes in vivo were studied. The changes in the occurrence rate of chromosome aberration were studied using peripheral blood before and 24 hours after irradiation in three patients with malignant melanoma. Only in the same individuals and the same irradiation field was there good correlationship between irradiation doses and occurrence rate. However, there was not always constant relationship between the occurrence rate of chromosome aberration and irradiation doses. This suggested that the occurrence of chromosome aberration was decided by both irradiation doses and size of irradiation field. (JA)

6670 (NRPB-R-31) RADIOLOGICAL PROTECTION OF PEOPLE EXPOSED TO PLUTONIUM: CURRENT RESEARCH AT THE NATIONAL RADIOLOGICAL PROTECTION BOARD. Stather, J. W.; Crawley, F. E. H.; Popplewell, D. S.; Stradling, G. N.; Brightwell, J.; Loveless, B. L.; Watts, L.; Purrot, R. J. (National Radiological Protection Board, Harwell (UK)). Oct 1974. 127p. Dep. NTIS (US Sales Only) $9.50. UK 50 pence.

The report consists of a general foreword on the current research program at the NRPB, followed by individual contributions on the following topics: the effect of chemical form on the tissue distribution and excretion of plutonium-239 following its deposition in the respiratory system of rodents; comparative studies on the clearance of plutonium-238, plutonium-239, americium-241, and curium-242 from the respiratory system of the rat; chemistry of plutonium incorporated in humans; a rapid method for the determination of plutonium in urine by ultra filtration; the efficiency of bronchopulmonary lavage as a therapeutic procedure for removing insoluble radioactive particles from the lung; studies of the removal of intracellular plutonium; analysis of data on the clearance of insoluble compounds of plutonium in the lung; chromosome aberrations in lymphocytes after plutonium intake by humans. (UK)

6671 (RD/B/M-3281) NOTES ON THE SECOND SYMPOSIUM ON NEUTRON DOSIMETRY IN BIOLOGY AND MEDICINE, NEUHERBERG, MUNICH, 30TH SEPTEMBER–4TH OCTOBER 1974. Harvey, J. R. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Jan 1975. 13p. Dep. NTIS (US Sales Only) $4.00.

Papers presented covered a number of related areas including neutron radiotherapy, basic radiobiology, and neutron detection instrumentation. The increasing application of neutrons to radiotherapy has initiated a reappraisal of many fundamental aspects of the measurement of neutron fields with ion chamber methods and some interesting discrepancies have been shown up by intercomparison studies between various groups. Progress in the use of neutron radiation to help in the understanding of fundamental radiobiological mechanisms is progressing slowly with an emphasis on the examination of the microscopic distribution of dose in increasingly small tissue volumes. Some interesting new solid state dosimetry systems have been discovered in which the response appears to mirror the multi-hit mechanisms appropriate to damage in biological systems. (auth)

6672 (SAAS-173) REPORTS OF THE STATE MINISTRIES FOR ATOMIC SAFETY AND RADIATION PROTECTION OF THE DDR. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)). Dec 1974. 21p. (In German). Dep. NTIS (US Sales Only) $4.25.

Separate abstracts were prepared for two sections of this report. (CH)

For abstracts of individual sections see: 6673 and 6825.

6673 (SAAS-173, pp 15-19) STATISTICAL EVALUATION OF EXTERNAL EXPOSURE OF OCCUPATIONALLY EXPOSED PERSONNEL IN THE GERMAN DEMOCRATIC REPUBLIC BY MEANS OF ELECTRONIC DATA PROCESSING. Aurisch, K.; Buschmann, R. Dec 1974. (In German).

In reports of the State Ministries for atomic safety and radiation protection of the DDR.

Eight input and twenty-four output programs with about 10,000 machine instructions have been developed for statistical evaluation of personnel radiation dosimetry and monitoring data of occupationally exposed personnel by means of the electronic calculator C 8202. Data dissection results in 26 data tables. Problem analysis, data preparation, and handling are briefly presented. (auth)

6674 (UR-3490-730) EFFECTS OF GONADAL IRRADIATION ON CLINICAL RADIATION THERAPY: A REVIEW. Lushbaugh, C. C.; Casarett, G. W. (Oak Ridge Associated Universities, Inc., Tenn. (USA). Medical Div.; Rochester Univ., N. Y. (USA). Dept. of Radiation Biology and Biophysics). 1974. 25p. (CONF-750128-3). Dep. NTIS $4.25.

From symposium on delayed consequences of cancer therapy; Orlando, Florida, USA (9 Jan 1975).

The possible late effects of radiotherapy resulting in irradiation of the gonads of both male and female patients and the potential of irradiation for inducing inheritable genetic damage are reviewed. It is concluded that the risk of birth defects or genetic damage of progeny is too remote to be considered as a deterrent to the use of radiotherapy or to justify the induction of permanent sterility in young patients. (CH)

6675 RADIATION SECURITY OF MEDICAL PERSONNEL IN CLINICAL USE OF RADIOACTIVE BEADS. Zol'nikova, N. I.; Vershinin, N. V.; Moiseitsev, P. I.; Ishchenko, Z. G. Med. Radiol.; 20: No. 4, 45-49(Apr 1975). (In Russian).

Radiation conditions of external γ radiation, levels of radioactive contamination of surfaces of workplaces, instruments, hands and overalls and also the levels of local doses of irradiation of the medical personnel during operation with radioactive beads with isotopes ^{60}Co made of a cobalt-nickel alloy with hermetizing gold coating are described in the article on the basis of radiation-dosimetric and radiometric investigations. The investigations showed that as a result of radiation-physical and chemical processes there takes place gradual destruction of the hermetizing coating and defixation of ^{60}Co on the surface of the beads. The level of radioactive contamination of the surface of the beads per one source (3.5 mg-equiv of radium) comprises $5.10^{-5} \pm 5.10^{-3}$ μ Ci. The content of ^{60}Co in sterilizing liquids in hot and cold sterilization comprises 3.10^{-9} to 2.10^{-8} Ci correspondingly in calculation per one source. The level of contamination of the surfaces of workplaces does not exceed 220 particles/cm^2 min, of instruments -30 to 480 particles/cm^2 min. The levels of local doses of irradiation for medicinal personnel measured by means of the method "IFK", for one intracavitary introduction of radioactive beads of the total activity of 43 mg-eqiv of radium are 2 to 10 mR for the head, 2 to 10 mR for the chest, 3 to 4 mR for the pelvis, and 5 to 15 mR for the hands. On the basis of the data obtained the authors elaborated recommendations aimed at optimization of the industrial surrounding and prophylaxis against irradiation of the personnel during the use of radioactive beads in clinical practice. (auth)

6676 IMPRINT SMEAR CYTOLOGY OF PELVIC LYMPH NODES AFTER LYMPHOGRAPHY AND X-RAY IRRADIATION. Kobayashi, A.; Iida, H. (Iwate Center for Adult Disease (Japan). Dept. of Gynecology); Kagabu, T. Nippon Rinsho; 13: No. 2, 198-208(Oct 1974). (In Japanese).

The following observations were made by imprint smear cytology of pelvic lymph nodes in patient with cervical cancer after lymphography; and irradiation. Influences of lymphography; As regards size distribution of reticulum cells, a bimodial distribution was observed. A tendency to enlargement of reticulum cells was also observed. Appearance of multinuclear histiocytes. Cytological changes due to Linac x-ray irradiation; Nuclei of reticulum cells decreased in size after 2,000 rad of Linac x-ray irradiation. Decrease in cell size was seen in multinuclear histiocytes. Enlargement and wide variation of the size of cells and nuclei were observed in plasma cells after 2,000 rad of radiation (in those cases lymphography was performed and positive metastasis revealed). Many of metastatic squamous cell carcinoma cells showed the typical radiation changes. (auth)

6677 DOSE-RESPONSE RELATIONSHIP OF LYMPHOCYTE CHROMOSOME ABERRATIONS IN LOCALLY IRRADIATED PERSONS. Matsubara, S.; Sasaki, M. S. (Tokyo Medical and Dental Univ. (Japan). School of Medicine); Adachi, T. J. Radiat. Res.; 15: No. 4, 189-196(Dec 1974).

The dose-response relationship of chromosome aberrations in the peripheral blood lymphocytes was studied in blood samples obtained from the patients who were exposed to a single dose of ^{60}Co γ rays for their malignant diseases. The level of chromosome aberration yield, as studied 24 hours after irradiation, was not simply related to the radiation dose per se, but body weight, irradiated volume, and radiation-induced inactivation of lymphocytes were found to be other important factors intimately related to the frequencies of chromosome aberrations; aberration yield expressed on the simple per-cell basis was roughly proportional to the irradiated volume and inversely proportional to the body weight. The intercomparison of the frequency of chromosome aberrations in these locally irradiated persons with that obtained by the in vitro experiments suggested the D_{37} value of about 350 rads for the survival of lymphocytes as measured 24 hours after irradiation. (auth)

6678 CHANGE IN DISTRIBUTION OF HUMAN B AND T-LYMPHOCYTES IN PERIPHERAL BLOOD INDUCED BY RADIOTHERAPY. I. Abe, Mitsunobu; Nakamura, M. (Tohoku Univ., Sendai (Japan). School of Medicine). Nippon Igaku Hoshasen Gakkai Zasshi; 34: No. 6, 399-403(Jun 1974). (In Japanese).

Radiotherapy for cancer patients leads to a lymphopenia. An analysis of the relative proportion of bone-marrow (B) and thymus (T) dependent lymphocytes in peripheral blood has been done in these patients. Two surface marker characteristics for B lymphocytes (Immunoglobulin determinants and receptors for antibody complement, EAC) and spontaneous rosette-forming capacity for sheep red blood-cells (E), a property of human T lymphocytes, have been investigated in peripheral blood lymphocytes of healthy controls (17 cases) and post-operative irradiated cancer patients (10 cases). Healthy controls had a mean of 24.4% Ig-bearing lymphocytes, 23.0% EAC-binding lymphocytes, and 48.8% E-binding lymphocytes. In cancer patients, there was a lymphopenia from a lymphocyte-count of 2080 per c.mm. of peripheral blood before irradiation to 934 lymphocytes per c.mm. immediately after radiotherapy. Cancer patients had a mean of 24.4%, 24.7%, and 49.9% respectively before radiotherapy and a mean of 37.6% Ig-bearing lymphocytes, 38.3% EAC-binding lymphocytes, and 42.9% E-binding lymphocytes after radiotherapy. The data suggest that radiotherapy for cancer patients leads to a lymphopenia which mainly is a selective T-lymphocyte lymphopenia. (auth)

6679 ON THE CANCEROUS TISSUE STROMA AND THE SPONTANEOUS STROMA OF THE PREOPERATIVELY IRRADIATED TISSUES OF GASTRIC CANCER. With Special Reference to AMPS of the Connective Tissue of Stroma. Makino, K.; Joko, Y.; Furuhata, T.; Kusumoto, Y.; Yumoto, K. (Tokyo Medical Coll. (Japan)). Gan No Rinsho; 20: No. 9, 667-674(Sep 1974). (In Japanese).

Histochemical investigation of the stromal acid mucopolysaccharides (AMPS) was made on the human gastric cancer tissues irradiated preoperatively. The tissues were fixed with 0.5% cetylpyridinium chloride in 10% (v/v) neutral formalin. For differentiation of AMPS, toluidine blue metachromasia method with or without treatment by AMPS-digesting enzymes was employed. It was found that the cancer stroma, the stroma of cancer itself, could be distinguished from the spontaneous one, by the strong AMPS-positiveness of the former. From this observation, the area of cancer nests contracted/or disappeared by radiation could be conjectured. This histochemical study revealed that there is hyaluronic acid predominantly next to chondroitin sulfate A/C in the gastric cancer stroma. (auth)

6680 CLINICAL EXPERIENCES WITH FAST NEUTRON THERAPY OF CANCER. Eichhorn, H. J.; Lessel, A. (Zentralinstitut fuer Krebsforschung, Berlin). Arch. Geschwulstforsch.; 43: No. 3, 268-276(1974). (In German).

Differences in efficacy between fast neutrons and γ-radiation are due to the higher RBE of the neutron rays, to the fact that their effect is independent of O_2-deficiency and to the decrease in intracellular repair capability. A pilot-test was made to examine the significance of these experimentally established differences in efficacy for radiotherapy. From 132 patients who are at present irradiated with neutrons, there are not available the results of the histological examination of the autopsy or surgical specimens of 24 bronchial carcinomata, 6 gastric carcinomata and 5 esophageal carcinomata. Radiotherapy was carried out with a combination of 6.2 MeV cyclotron neutrons (20 to 35% of the total dose) and subsequent (sometimes preceding) telecobalttherapy. A small number of patients were irradiated either exclusively with neutrons or with a neutron proportion of only 12% of the total dose. A thorough histological examination (no serial sections) of the autopsy or surgical specimens was made whether tumor tissues could be detected. For comparison use was made of analogous

histological examinations of patients who had received telecobalt-therapy only (no random sampling). The result, which can only be regarded as a sample taken offhand because of the small number of histologically evaluable neutron-therapy patients, was that irradiation in combination with neutrons resulted in a substantially higher number of histologically confirmed tumor destruction for bronchial carcinomata (0.7 : 0.33) and gastric carcinomata than in the cases of exclusive telecobalttherapy, although the total dose for the n + γ-cases was often smaller and the total duration of irradiation was twice as long. In the case of exclusive neutron irradiation, complete destruction of bronchial carcinoma could already be observed after treatment with a ≈2100 rem tumor dose, whereas in the case of exclusive telecobalttherapy this was obtained only after applying 3500 RHD. The sequences N + γ or γ + N appeared to have no influence on the increase in efficacy. For the esophageal carinomata, however, a complete destruction of the tumor could not be established (in contrast to 14/31 after exclusive telecobalttherapy), but in this case the total dose of the combined n + γ sequence had been smaller by one third. The general reactions were more pronounced after neutron irradiation than after telecobalt irradiation, resembling those after 250-KV-therapy. It is pointed out that with regard to neutron efficacy, consideration should be given not only to the O_2-effect and to the repair mechanism but also to the almost equally strong action on the cells caused by the higher LET during every phase of the division cycle. (auth)

6681 POSTMORBID INVESTIGATION OF THE PROGENY OF PATIENTS WITH IRRADIATED SCROTAL TUMORS. Krueger, W. Munich; Technische Univ. (1974). 87p. (In German). INIS. Thesis.

Following an extensive literature review, a report is made on 107 patients with scrotal tumors relating to the breakdown into subtype, anamnesis, age, and lateral distribution. The therapeutic results were significantly improved after introduction of routine irradiation of the paraaortal lymph node. Lymphography proved to be an important diagnostic criterium for the diagnosis of metastases. Information on the family situation was gained from 53 patients. Most of them (73.6%) became fathers before the appearance of sickness. Four patients became fathers of a total of 7 children. The children were not significantly different from the total population. However, it must be taken into account that disturbances in fertility may occur post-radiotherapy in about 50 to 75% of the patients. (GE)

6682 LYMPHADENECTOMY COMBINED WITH PREOPERATIVE AND POSTOPERATIVE COBALT 60 TELETHERAPY IN THE MANAGEMENT OF EMBRYONAL CARCINOMA AND TERATOCARCINOMA OF THE TESTIS. Nicholson, T. C.; Walsh, P. C.; Rotner, M. B. (Naval Hospital, San Diego, CA). J. Urol.; 112: 109-110(Jul 1974).

An over-all survival rate of 83 percent was obtained among 35 patients with stages A and B embryonal carcinoma and teratocarcinoma of the testis treated with preoperative and postoperative cobalt teletherapy combined with radical retroperitoneal lymphadenectomy. Bone marrow depression and the possible induction of a second malignancy were the most significant side effects of radiation therapy. Comparable survival rates have been reported by other investigators using lymphadenectomy alone. (auth)

6683 RADIATION THERAPY OF INOPERABLE LOCALIZED PROSTATIC CARCINOMA: AN ASSESSMENT OF TUMOR RESPONSE AND COMPLICATIONS. Green, N.; Melbye, R. W.; George, F. W. III; Morrow, J. (Univ. of Southern California, Los Angeles). J. Urol.; 112: 662-664(Jul 1974).

Between 1965 and 1971, 50 patients with inoperable localized prostatic carcinoma were treated with radiotherapy and, of these, 18 patients also received estrogens. Favorable tumor responses were more frequently observed in patients with less advanced tumors treated with 6,000 R or more and in those who also received estrogens. Tumor regrowth was uncommon beyond the second year after radiotherapy. Complications were more frequently observed in patients with advanced tumors who had urologic symptoms, in those treated to 7,000 R or more and in those who had urologic operation at any time prior to radiotherapy. Concurrent urologic infections, instrumentation and catheterization probably also predisposed to complications. Therapeutic measures were suggested to increase the incidence of tumor response and decrease the incidence of complications. (auth)

6684 ADULT STATURE IN RELATION TO CHILDHOOD EXPOSURE TO THE ATOMIC BOMBS OF HIROSHIMA AND NAGASAKI. Belsky, J. L.; Blot, W. J. (Atomic Bomb Casualty Commission, Hiroshima). Amer. J. Pub. Health; 65: No. 5, 489-494(May 1975).

Height and weight measurements were obtained for adults who were under age 18 at the time of the atomic explosions of 1945 in Hiroshima and Nagasaki. Adult height was found to be significantly lowered among Hiroshima survivors. (auth)

6685 /sup 99m/Tc-PERTECHNETATE THYROID SCINTIGRAPHY IN PATIENTS PREDISPOSED TO THYROID NEOPLASMS BY PRIOR RADIOTHERAPY TO THE HEAD AND NECK. Arnold, J.; Pinsky, S.; Ryo, U. Y.; Frohman, L.; Schneider, A.; Favus, M.; Stachura, M.; Arnold, M.; Colman, M. (Michael Reese Hospital and Medical Center, Chicago). Radiology; 115: No. 5, 653-657(Jun 1975).

Histories, physical examinations and /sup 99m/Tc-pertechnetate imaging were used to evaluate 1,452 persons who had x-ray therapy to the neck region for benign conditions 18 to 35 years previously. Thyroid abnormalities were found in 301 patients (21 percent) and thyroid malignancy was found in 29 percent of 193 patients with abnormal studies who were explored surgically. Thyroid imaging detected 96 percent of these abnormalities, 40 percent of which would not have been unequivocally established by physical examination alone. Nuclear imaging could not distinguish benign from malignant lesions. (auth)

6686 SURVEY OF MALPRACTICE CLAIMS IN DERMATOLOGY. Altman, J. Arch. Dermatol.; 111: No. 5, 641-655 (May 1975).

A statistical survey of malpractice claims asserted against dermatologists was made. The subject matter of the claims was divided into eight major categories: drug reactions, x-ray burns, poor cosmetic result following surgery, poor cosmetic result following medication, failure to diagnose cancer, improper diagnosis, infection from treatment, and miscellaneous. The study showed that a group of "serious" damage cases, which accounted for 34 percent of total claims, generated 94 percent of total dollar losses. The problem areas for malpractice claims appeared to be drug reactions, cosmetic chemosurgery, and failure to diagnose cancer. (auth)

6687 RADIATION THERAPY OF BRAIN TUMORS IN CHILDREN. Onoyama, Y.; Abe, M.; Takahashi, M.; Yabumoto, E.; Sakamoto, T. (Kyoto Univ. Medical School). Radiology; 115: No. 5, 687-693(Jun 1975).

The case histories of 124 children irradiated for brain tumors were reviewed to determine survival rate and functional prognosis, with special reference to somatic growth. Five-year survival rates (29 percent of 97 patients with gliomas and 70 percent of 27 patients with nongliomatous tumors) were approximately the same as in our adult series, despite the differences in histology and predilection. Although 70 percent of 42 long-term survivors had active, useful lives, stunted growth was observed in 15 of them. More attention should be directed to the growth of children irradiated for brain tumors. (auth)

6688 LOW-MEGAVOLTAGE ELECTRON-BEAM THERAPY OF HEAD AND FACIAL SKIN CANCER USING A VERSATILE POLYSTYRENE COLLIMATOR SYSTEM. Johnson, T. S.; Garciga, C. E.; Feldman, M. E.; Holcomb, M. H. (Veterans Administration Hospital, Miami). Radiology; 115: No. 5, 695-699(Jun 1975).

Twenty patients with multiple or recurrent superficial head and facial cancer were treated with low-megavoltage electron-beam therapy, using a readily adaptable polystyrene shield assembly with interchangeable collimators. Patient set-up times were reduced, treatment was simplified, and flexibility of therapy was achieved. Therapeutic response was excellent even in patients with extensive primary or recurrent skin cancer requiring large-field irradiation. (auth)

6689 RELATIVE DOSES TO SKIN AND SUPERFICIAL NODES FROM 10 MV PHOTONS AS A FUNCTION OF FIELD SIZE AND DISTANCE FROM SHADOW TRAY. Bassano, D. (Univ. of Rochester Medical Center, NY). Radiology; 115: No. 5, 707-710(Jun 1975).

Although low entrance doses are desirable for cosmetic and tolerance reasons, they may leave the superficial nodes underdosed. Surface dose dependence on area and distance from the shadow tray for 10 MV photons was studied and comparisons made with ^{60}Co and 4 MV energies. The use of 10 MV photons would leave superficial nodes underdosed unless a bolus or supplementary treatment, such as electrons, is used. Treatment planning implications for a mantle field are discussed. (auth)

6690 STERNAL CHANGES FOLLOWING MEDIASTINAL IRRADIATION FOR CHILDHOOD HODGKIN'S DISEASE. Morris, L. L.; Cassady, J. R.; Jaffe, N. (Harvard Medical School, Boston). Radiology; 115: No. 5, 701-706(Jun 1975).

Sternal changes following mediastinal irradiation are described in 78 children with Hodgkin's disease. Incidence and severity of changes are correlated with total sternal dose. Megavoltage irradiation, with a nearly equal absorbed dose ratio between bone and soft tissue, and improved depth dose characteristics, has

markedly decreased the incidence and severity of bone changes. No moderate or severe changes developed following megavoltage techniques, in contrast to orthovoltage therapy. (auth)

6691 INVESTIGATION OF THE EFFECT OF COMBINED TREATMENT WITH X RAYS AND THIO-TEPA IN CELLS OF HUMAN EMBRYOS CULTIVATED IN VITRO DEPENDING ON THE TIME INTERVAL BETWEEN THE TREATMENTS. Korotkikh, I. M.; Tarasov, V. A.; Schvetsova, T. P. (Inst. of General Genetics, Moscow). Genetika; 10: No. 12, 152-155(Dec 1974). (In Russian).

The object of this investigation was the effect of a combined treatment with thio-TEPA at a $1 \cdot 10^{-4}$ M concentration and with x rays at a 50 R dose. The mutability increased with the increase of the time interval between the treatments from 0 to 1 hour and decreased with the subsequent increase of this interval to 3 and 6 hours, attaining an additive level at 10 and 18 hours' intervals. Such changes of the mutability were observed irrespective of whether thio-TEPA was administrated before or after x irradiation. The results obtained are indicative of the process of stabilization of potential chromosome changes taking place in cells. This process is not associated with any stage of the mitotic cycle. (auth)

6692 RADIATION MONITORING OF PERSONNEL DURING WORK WITH DIFFERENT γ-THERAPEUTIC APPARATUS. Zol'nikova, N. I.; Merkulova, T. I.; Ishchenko, Z. G. Med. Radiol.; 20: No. 5, 46-50(May 1975). (In Russian).

Results are presented of radiation-hygienic investigations of working conditions of medical personnel in tele-gammatherapy departments of 26 major oncological centers in Moscow, Minsk, Vilnus, Kishinev, Riga, Kaunas, and other cities. The sections are equipped with modern Soviet-made gamma-therapeutic apparatus ГУТ-Co-400, modernized ГУТ-Co-800, "Luch", "Rokus", "Volfram", "Agat-C", foreign made "Theratron", and others. As a result of the study it was established that the dose of gamma radiation in the operator's workplace comprises: in ГУТ-Co-400 from 15.0 to 115.0 mR/hr, in modernized ГУТ-Co-800 from 0.36 to 3.0 mR/hr, in more perfect gamma apparatus "Luch-1", "Rokus", and others from 0.07 to 1.0 mR/hr. The level of irradiation doses for medical personnel during operation on the ГУТ-Co apparatus with a full charge (400 g/eq radium ^{60}Co) is 120 to 360 mR/month, on the ГУТ-Co-800-50 to 80 mR/month, on the "Luch-1", "Rokus", "Volfram"-40 to 85 mR/month. The chronometry of placing patients with different localization of the affections on various gamma-therapeutic apparatus is presented. (auth)

6693 CALCULATION OF RADIATION DOSE FIELDS WITH THE USE OF PROTECTIVE BLOCKS. Galina, L. S. Med. Radiol.; 20: No. 5, 59-65(May 1975). (In Russian).

The method of dose field calculation in tele-gammatherapy with the use of protective blocks which are placed within the geometrical irradiation field is proposed. The author studied general regularities of a dose field in different parameters of the block and conditions of irradiation. Recommendations are given on some parameters of the block. Coincidence of estimated and experimental data is good. (auth)

6694 RESTORATION OF HEMOPOIESIS IN PATIENTS FOLLOWING CHRONIC RADIATION SICKNESS. Gribova, I. A.; Soldatva, V. A. (Scientific-Research Inst. of Industrial Hygiene and Occupational Disease, Moscow). Med. Radiol.; 20: No. 5, 25-29(May 1975). (In Russian).

Observations were made on 88 patients who sustained chronic radiation sickness in the past. The condition of their blood was satisfactory, however, in the considerable number of cases subnormal indices of the leukocyte count or moderate leukopenia were observed. Dependence of hematological indices upon the time of discontinuation of the contact with radiation was revealed. It was established that possible incorporation of radioactive substances, concomitance of different somatic diseases and also old age of the patients influenced the retardation of restorative processes. Studies of hemopoiesis showed that only in single cases the decrease of the leukocyte count was caused by the tendency to hypoplastic processes. In the majority of the patients disorders of hemopoiesis were of a functional character with signs of incomplete compensation of granulocytopoiesis. (auth)

6695 LEUKEMIA IN PATIENTS WITH A MANY-YEAR COURSE OF LYMPHOGRANULOMATOSIS. Belugina, Z. T.; Kozyrina, Z. N.; Komarova, R. S. Med. Radiol.; 20: No. 5, 25-29(May 1975). (In Russian).

The development of leukemia in two patients with a 13- and 27-year course of lymphogranulomatosis is reported. Cumulative exposure dose of the local many-field irradiation in them comprised accordingly 95,800 and 26,637 R. (auth)

6696 COMPLICATIONS IN PATIENTS FOLLOWING TELE-GAMMATHERAPY IN CERVIX UTERI CANCER. Falileeva, E. P.; Teleus, T. A.; Kozlova, E. S. (Moscow Scientific-Research Oncology Inst.). Med. Radiol.; 20: No. 5, 37-41(May 1975). (In Russian).

Postradiational complications were studied in two groups of patients with cervix uteri cancer, who underwent a combined radiation therapy, when the component of tele-gammatherapy was conducted in static (1 group) and movable (2 group) conditions. The comparative analysis of clinical observations made over 2 groups of patients showed that the use of movable tele-gammatherapy (in 100 patients with terms of irradiation of 1 to 3 years) made it possible to avoid a number of grave complications which occurred in static tele-gammatherapy. Not a single patient had fibrous changes of panniculus adiposus, fractures of os coxae were not observed either. Recto-sigmoiditis, strictures or necrosis of the intestine in this group of patients were not registered. (auth)

6697 RADIATION INJURY OF THE RECTUM FOLLOWING TREATMENT OF CERVIX UTERI CANCER. Vishnevskaya, E. E.; Nalivaiko, T. M. Med. Radiol.; 20: No. 5, 42-46(May 1975). (In Russian).

Rectovaginal fistulas were analyzed in 72 patients with cervix uteri cancer, 66 of them underwent only combined radiation treatment. Dependence of fistula development on the methods of teletherapy and application of different sources of energy were studied. An assessment is given of intracavitary gammatherapy of the criteria of the cumulative dose loads supplied to the tumor foci, adequacy of the radiation system arrangement, and relation between intravaginal and intrauterine applicators. The influence of clinical factors on the possibility of rectovaginal fistula development (dissemination of the tumoral process, presence of concomitant diseases, peculiarities of anatomical location of the small pelvic organs) was determined. Ways of prophylaxis of radiation complications occurring in the rectum are outlined. (auth)

6698 RADIOTOXIC HAZARD MEASURE FOR BURIED SOLID RADIOACTIVE WASTE. Hamstra, J. (Reactor Centrum Nederland, The Hague). Nucl. Safety; 16: No. 2, 180-189(1975).

The radiotoxic hazards resulting from the disposal of high-level reprocessing wastes into a deep geological formation are reviewed. The term radiotoxic hazard measure (RHM), used to measure the hazard from buried radioactive wastes, is based on the maximum radionuclide concentration permissible in water. Calculations are made of the RHM levels for the high-level reprocessing wastes of both light-water-reactor and fast breeder reactor fuels. In comparing these RHM levels with that for the natural activity of an equivalent amount of uranium ore and its mill tailings, it is concluded that an actual additional radiotoxic hazard for buried high-level reprocessing waste only exists for the first 300 to 500 years after burial. (auth)

6699 INDUCED CHROMOSOMAL ABERRATIONS IN MAN. Bloom, A. D. (Univ. of Michigan, Ann Arbor). Advan. Hum. Genet.; 3: 99-172(1972).

Methods used to study chromosomes in human cells are discussed with emphasis on the use of cultured cells to study aberrations induced in vivo and in vitro by exposure to drugs, viruses, chemical mutagens, or ionizing radiations. Data are reviewed from a number of studies on chromosomal aberrations in cultured lymphocytes from individuals exposed internally or externally to various doses of ionizing radiations. The relationship between radiation dose and the induction of chromosomal aberrations is discussed. Data are included on chromosomal aberrations in A-bomb survivors of Hiroshima and Nagasaki exposed to high doses of acute irradiation and the subsequent incidence of neoplasms. (CH)

6700 THE POST-OPERATIVE RADIOTHERAPY OF THE MAMMA CARCINOMA. INVESTIGATIONS OF OPTIMUM DOSE DISTRIBUTIONS FOR IRRADIATION OF THE THORACIC WALL BY MEANS OF TANGENTIAL STANDING FIELDS. II. Isodoses and Tables. Heilmann, H. P. Tuebingen, Ger.; Tuebingin Univ. (1972). 144p. (In German). INIS.

Thesis.

Experimental investigations are reported for the study of dose distributions on the thoracic wall in irradiation via tangential standing fields. A special water-model with particularly thin walls as well as a Machlett-Alderson-Rando-Man-Phantom were used for the measurements. The dosimetry was performed by ionometry with a micro-tube-chamber and the Duplex-dosimeter on the water-phantom, by thermoluminescence dosimetry with Lif TLD-100 dosimeters on the Alderson-phantom. The measured values were recorded on punched tapes and processed in a computer. By arithmetic superimposition of the counter-fields the isodoses of the superimposition could be demonstrated. The arithmetic variation of the irradiation parameters (angle of

incidence, exposure) made it possible to study various modes of irradiation. The measurements were made for kilovolt technique, the tele-cesium-apparatus, the tele-cobalt apparatus, and the 17-MeV-Betatron for ultrahard x-ray radiation. The accuracy of the dose distributions found on the water-model could be tested by comparison with the results obtained on the body-equivalent model. With tele-cesium, tele-cobalt and ultrahard x-rays using tangential counter-fields, an equal perradiation of the thoracic wall was attained, with adequate to satisfactory protection of the lung tissue, whereas the conventional deep x-ray therapy did not guarantee satisfactory dose distributions. An improvement of the dose distribution by different exposure of the fields was not possible. Differences of the dose distribution on the Alderson model are caused by inhomogeneities of the tissues. With the kilovolt-technique, particularly before the superimposition of the standing fields, a marked influence caused by inhomogeneities was observed. Conclusions are drawn for practical radiotherapy and a technique of adjustment to the patient was described which permits reproducible irradiations and the use of the resulting isodoses. (GE)

6701 THE POST-OPERATIVE RADIOTHERAPY OF THE MAMMA CARCINOMA. INVESTIGATIONS OF OPTIMUM DOSE DISTRIBUTIONS FOR IRRADIATION OF THE THORACIC WALL BY MEANS OF TANGENTIAL STANDING FIELDS. I. Full Text and Figures. Heilmann, H. P. Tuebingen, Ger.; Tuebingen Univ. (1972). 99p. (In German). INIS.

Thesis.

Experimental investigations are described that were carried out on a special water phantom with particularly thin walls as well as a Machlett-Alderson-Rando-Man phantom in which the usual bore holes were replaced by a point lattice of microbores with a lattice pitch of 1.5 cm. Dosimetric measurements were made ionometrically on the water phantom and for the Alderson phantom, TLD-100 dosemeters were used. The measured values were standardized by a computer program and printed out as isodoses. The superimposed isodoses were obtained by computational superposition of opposing fields and the mathematical variation of irradiation parameters (angle of incidence, etc.) allowed the examination of various irradiation procedures. Measurements were carried out using the kilovolt technique, with the tele-cesium device, the tele-cobalt device, and the 17-MeV betatron with ultrahard x-ray irradiation. Uniform irradiation of the thoracic wall with good or satisfactory protection of the lung can be obtained with the tele-cesium device and even better with the tele-cobalt device using ultrahard x-rays, whereas in the conventional deep x-ray therapy, the dose distribution is not satisfactory as the dose applied to the region between the two fields is not sufficient. For tele-cesium and tele-cobalt irradiation, differences in dose distribution due to tissue inhomogeneities, measured in the Alderson phantom and compared with those obtained in the water phantom, could be detected but were too slight. Using the kilovolt irradiation, however, considerable effects of inhomogeneities could be clearly detected prior to the superimposition of the standing fields. The conclusions to be drawn from these results with regard to practical radiotherapy are discussed and irradiation techniques are described that will allow reproducible irradiations to be made using the given isodoses. (GE)

6702 DOSIMETRY OF TREATMENTS OF CARCINOMA OF THE CERVIX. (Fletcher Technique). Assuncao, D. G.; Quaresma, A. N. Arq. Patol. (Lisbon); 46: No. 2-3, 107-116(1974). (In Portuguese).

The Fletcher technique employed in the treatment of cancer of the cervix in Instituto Português de Oncologia de Francisco Gentil and its advantages as an afterloading technique are described from the point of view of protection against radiations for doctors and nurses. The dosimetry of these applications made to each patient after the antero-posterior and lateral radiographs is described. (auth)

6703 POSSIBILITIES OF TRITIUM APPLICATION FOR INTRATISSUAL RADIATION THERAPY OF TUMORS. Vdovenko, V. M.; Ivanov, I. I.; Bobrova, V. N.; Rumyantseva, L. N.; Shestakov, A. D.; Gavrilenko, I. S.; Chernyseva, L. F. Radiobiol. Radiother.; 16: No. 1, 27-35(1975). (In German).

The methods elaborated for the incorporation of tritium into the molecules of naphtidon, DOPA, and pyrocatechin by chemical synthesis guarantee the production of appropriate preparations of high specific activity (~150 Ci/g) which are sufficient to achieve a therapeutically effective radiation dose to the tumor. Storage of these highly active tritium preparations requires the consideration of special safety measures. As was shown by practical experience, decomposition rate decreases with storage of solutions in phials under low temperature (in solid carbonic acid, in liquid nitrogen). The preparations of the given compounds with radionuclides of hard radiation ^{131}I, ^{125}I are suitable for the determination of tumor types in which the preparation is locally accumulated but also for the individual judgement of the affinity of the preparation to the patient's tumor. The percentage of growth retardation of melanomas (~85%) and the absence of leucocyte decrease in the peripheral blood with combined action of tritium-DOPA-^3H and cyclophosphamide are the basis for attempts of a therapeutic application of this method to melanoblastoma. Based on the data of the biological study of tritium-containing preparations DOPA and naphtidon carried out at the Institute of Biophysics of the Ministry of Health of the USSR, at the Scientific Research Institute of Oncology and Medical Radiology of the Ministry of Health of the BSSR, at the Institute of Experimental and Clinical Oncology of the Academy of Medical Sciences of the USSR, and at the Medical Military Academy S. M. Kirkow, the Board of Pharmacology of the Ministry of Health of the USSR sanctioned the clinical testing of DOPA-^3H and naphtidon-^3H by regional perfusion and infusion, respectively. The search for new specific compounds which may serve as tritium carriers into the tumor and the improvements of methods of introduction of preparations into the living organism may render radioactive antitumorous preparations an important mean for the fight against oncological diseases. (auth)

6704 LIGHT FLASHES OBSERVED BY ASTRONAUTS ON SKYLAB 4. Pinsky, L. S. (Univ. of Houston, TX); Osborne, W. Z.; Hoffman, R. A.; Bailey, J. V. Science; 188: No. 4191, 928-930(30 May 1975).

Two dedicated light flash observing sessions were conducted by one of the crewmen during the Skylab 4 mission. Analyses of his observations reveal a strong correlation between flash frequency and primary cosmic-ray flux, and an even stronger correlation between flash frequency and the South Atlantic Anomaly (SAA) region of the inner belt trapped radiation. Calculations indicate that an all-proton inner belt probably cannot produce the observed SAA flash rate, and they suggest that there may exist a previously unobserved inner belt flux of multiply charged nuclei. (auth)

6705 RADIOTHERAPEUTIC MANAGEMENT OF MALIGNANT MELANOMA OF THE EYE. Ehlers, G.; Batley, F.; Kartha, M. (Ohio State Univ. Hospital, Columbus). Am. J. Roentgenol., Radium Ther. Nucl. Med.; 123: No. 3, 486-491(Mar 1975).

From 75th annual meeting of the American Roentgen Ray Society; San Francisco, CA (24 Sep 1974).

A review of 18 patients with melanoma of the choroid, treated with radiation, is presented. The treatment method used requires close cooperation between the ophthalmologist and radiotherapist. Preoperative evaluation of the tumor size is paramount for proper selection of patients who may benefit from this type of treatment. The procedure consists of the surgical implantation of a specially prepared applicator containing radioactive sources (radon seeds), the technique being a modification of that used and described by Stallard. Results so far are encouraging enough to continue its use. Local control of disease without undue morbidity from the procedure itself and with preservation of useful vision in the involved eye was achieved in 11 of 18 patients. Thus the treatment was locally successful in 61 percent of all patients, whereas 7 patients (39 percent) are considered local treatment failures. Only 2 patients have so far died of distant metastases, representing 40 percent of patients treated 5 years ago. One of these 2 patients survived 67 months and the other 35 months following radiation treatment. Further loss of vision in the treated eye was the most frequent complication, culminating in enucleation in some patients. Of the 6 patients who underwent enucleation, 5 did so because of inadequate local tumor response, and 1 because of complication due to severe retinal detachment. Of the enucleated eyes, only 1 had a tumor smaller than 10mm diameter. The time of enucleation, except for 1 patient, was less than 1 year after irradiation. In Case 12, one could have anticipated local treatment failure, since the lesion was actually larger than the diameter of the applicator used. This unfortunately happened because of an inaccurate estimation of the size of the tumor a few weeks before the scheduled implantation procedure. At the time of surgery, the tumor was found to be considerably larger than the applicator prepared for it. The possibility of an unusually rapid growth of this particular tumor cannot be ruled out, of course. In this series of patients there is no correlation between local treatment failure and the dose of radiation given. Histologically, most patients whose eyes were enucleated had spindle cell B type tumors. Further use of this technique, with long-term follow-up examination of treated patients, seems justified to better assess the true value of this treatment method. (auth)

6706 RESULTS OF SURGICAL AND RADIATION THERAPY IN THE TREATMENT OF LIPOSARCOMA ARISING IN AN EXTREMITY. Shiu, M. H.; Chu, F.; Castro, E. B.; Hajdu, S. I.; Fortner, J. G. (Memorial Sloan-Kettering Cancer Center, New York). Am. J. Roentgenol., Radium Ther. Nucl. Med.; 123: No. 3, 577-582(Mar 1975).

From 56th annual meeting of the American Radium Society; Maui, HI (21 Apr 1974).

The results of surgical and radiation therapy are analyzed in a retrospective review of liposarcomas arising in an extremity treated at Memorial Sloan-Kettering Cancer Center between 1949 and 1967. The 5 year and 10 year survival rates were 62 percent and 51 percent after curative therapy; 27 percent of patients developed local recurrences and 40 percent developed metastases. Adjunctive radiation therapy was employed in 11 patients, 9 of whom survived over 5 years (82 percent). Radiation therapy produced subjective and objective responses in many cases of local recurrences and metastases, with complete regression of tumor and prolonged survival in some instances. A combined surgical and radiotherapeutic approach to these tumors appears to offer distinct advantages, and may have obviated the need for amputation in some cases. (auth)

6707 EVALUATION OF THERAPEUTIC RESULTS IN EWING'S SARCOMA. Johnson, R. E.; Pomeroy, T. C. (National Cancer Inst., Bethesda, MD). Am. J. Roentgenol., Radium Ther. Nucl. Med.; 123: No. 3, 583-587(Mar 1975).

From 56th annual meeting of the American Radium Society; Maui, HI (21 Apr 1974).

The philosophy pervading the treatment approach to Ewing's sarcoma was to have therapy encompass all foci of disease, including sites of occult or potential involvement in addition to obvious clinical manifestations. The experience with integrated methods of treatment in 66 consecutive patients at the National Cancer Institute is reviewed. A median survival of 18 months (44 percent 2 year survival rate) for patients with recognizable metastases on admission bears impressive witness to the value of adjuvant therapy in Ewing's sarcoma. Even more encouraging, an uncorrected 5 year survival rate of 53 percent (42 percent continuously free of disease) for patients given "prophylactic" adjuvant therapy indicates the potential for permanent control of disease in a significant fraction of cases with clinically localized primary tumors. (auth)

6708 OSTEOGENIC SARCOMA (OSTEOSARCOMA): RESULTS OF THERAPY. Stein, J. J. (UCLA Center for Health Sciences, Los Angeles). Am. J. Roentgenol., Radium Ther. Nucl. Med.; 123: No. 3, 607-613(Mar 1975).

From 56th annual meeting of the American Radium Society; Maui, HI (21 Apr 1974).

Between November 1, 1955 and June 30, 1973, 46 patients with osteosarcoma without evidence of metastases were admitted to the UCLA Center for Health Sciences. The follow-up was 100 percent. The plan for therapy after biopsy has been to give preoperative megavoltage radiation therapy, 6,000 to 7,000 rads tumor dose at the rate of 900 rads per week to the whole limb or bone involved and then to consider surgical ablation 4 to 6 months later, if metastases have not occurred. The average duration of symptoms was 2.5 months, and the average time period for the appearance of metastases calculated from the onset of therapy was 5.5 months. Eighty-seven percent had metastases within a period of 14 months after diagnosis with the majority appearing usually in the lungs in 9 months or less. There have been 11 long-term survivors. There were no 5 year survivors from surgery only. There were 3 long-term survivors from radiation therapy only; 6 who were treated by radiation therapy and surgery; 1 treated by surgery, radiation therapy, and chemotherapy; and 1 who had radiation therapy and chemotherapy. It is believed that maximum results which can be obtained from surgery alone or from preoperative radiation therapy plus ablative surgery have been achieved, and the results are approximately 20 percent 5 year survivals. Since osteosarcoma is a systemic disease and because of the brief period of symptoms and rapid onset of metastases following therapy, any further improvement in survival statistics will have to be the result of additional therapy directed to the prevention of systemic spread of the disease. There are some cases of osteosarcoma which represent localized disease, possibly 5 to 15 percent, but there is no method to determine which ones they are at the present time prior to the initiation of therapy. (auth)

6709 ADENOCARCINOMA OF THE ENDOMETRIUM: VAGINAL RECURRENCES AND MORTALITY. Kagan, A. R.; Nussbaum, H.; Ziel, H.; Gordon, J. Am. J. Roentgenol., Radium Ther. Nucl. Med.; 123: No. 3, 567-570(Mar 1975).

From 75th annual meeting of the American Roentgen Ray Society; San Francisco, CA (24 Sep 1974).

Patients with deep myometrial invasion are at risk for vaginal and/or pelvic recurrence. More intensive postoperative irradiation is indicated. Patients with undifferentiated lesions are at high risk for vaginal and/or pelvic recurrence. These patients should have more intensive preoperative irradiation than we have previously given, to reduce the risk of local recurrence. Both groups of patients are at risk for development of pelvic, abdominal, and distant metastases. Early use of progestins when there is evidence of recurrent disease is recommended. Elective chemotherapy should be considered when a more effective agent is available than we presently have. (auth)

6710 STAGE I WELL DIFFERENTIATED ADENOCARCINOMA OF THE ENDOMETRIUM. Green, N.; Melbye, R. W.; Kernen, J. (Hospital of the Good Samaritan, Los Angeles). Am. J. Roentgenol., Radium Ther. Nucl. Med.; 123: No. 3, 563-566(Mar 1975).

From 75th annual meeting of the American Roentgen Ray Society; San Francisco, CA (24 Sep 1974).

The experience of 112 patients with well differentiated adenocarcinoma of the endometrium Stage I disease was reviewed. All patients had a total hysterectomy and bilateral salpingo-oophorectomy; 13 patients had adjuvant radiotherapy. The clinical stage correlated well with the pathologic stage and could be used with confidence to determine proper treatment. Almost all patients had noninvasive or minimally invasive carcinoma. No patient had tumor extension beyond the corpus. Total hysterectomy alone gave excellent results. No patient developed vaginal or pelvic recurrence, distant metastases or death caused by endometrial cancer. The possibility of late recurrence and metastases could not be excluded. (auth)

6711 TUMORS OF THE UPPER UROTHELIUM. Rafla, S. (Methodist Hospital, Brooklyn). Am. J. Roentgenol., Radium Ther. Nucl. Med.; 123: No. 3, 540-551(Mar 1975).

From 56th annual meeting of the American Radium Society; Maui, HI (21 Apr 1974).

Forty-two cases of malignant tumors of renal pelvis were reviewed: 28 were transitional cell carcinomas; and 14 were squamous cell carcinomas. The natural history and spread of the disease is discussed in detail. Transitional cell carcinomas spread primarily to the ureter (40 percent), followed closely by the renal bed (33 percent) and bladder (30 percent). Squamous cell carcinomas spread primarily through the renal bed (60 percent), followed by the draining lymph nodes (28 percent). The spread to other regions (bones, splanchnic organs, chest, etc.), occurred with relatively less frequency, but more in squamous than transitional cell carcinomas. Transitional cell carcinomas seem to have a longer natural history than squamous cell carcinomas. Recurrences in bladder and the remainder of the urothelium seem to be controlled for relatively long periods of time, while those in lymph nodes and renal bed seem to be rapidly fatal. The results of treatment and factors influencing them are discussed. Patients suffering from transitional cell carcinomas faired better than those with squamous cell carcinomas at the 5 year mark (25 and 15 percent, respectively), but the 10 year results are poor in both. The role of radiotherapy in the treatment of these tumors and the influencing factors are also discussed in detail. The response of these tumors to radiotherapy seems to be akin to that of the lower urothelium (bladder), provided adequate dosage is delivered to the relevant volume at the proper moment in time. (auth)

6712 ROLE OF RADIATION THERAPY IN THE TREATMENT OF PAROTID CARCINOMAS. Rossman, K. J. (Ohio State Univ. Hospital, Columbus). Am. J. Roentgenol., Radium Ther. Nucl. Med.; 123: No. 3, 492-499(Mar 1975).

From 56th annual meeting of the American Radium Society; Maui, HI (21 Apr 1974).

Radiation therapy appears to be useful in postoperative management of patients with parotid gland tumors. Because the local recurrence rate is excessive, postoperative irradiation should be routinely considered for high grade mucoepidermoid carcinomas, all squamous cell, adeno- and undifferentiated carcinomas of the parotid. Doses should be at least equivalent to 6,500 rads in 6 weeks to 4 cm depth (or measured tumor depth). The radiation fields should cover the base of skull and lower neck to prevent extension of the cancer. (auth)

6713 RADIATION THERAPY OF MENINGIOMAS. Wara, W. M.; Sheline, G. E.; Newman, H.; Townsend, J. J.; Boldrey, E. B. (Univ. of California School of Medicine, San Francisco). Am. J. Roentgenol., Radium Ther. Nucl. Med.; 123: No. 3, 453-458(Mar 1975).

From 75th annual meeting of the American Roentgen Ray Society; San Francisco, CA (24 Sep 1974).

On the basis of the data it was concluded that: (1) if a meningioma can be totally resected, surgical excision is the treatment of choice; (2) if resection is incomplete, radiation therapy may prevent or markedly delay recurrence; (3) some previously nonirradiated recurrent meningiomas may be controlled by irradiation for extended periods of time; (4) the resectability of certain highly vascular meningiomas may be increased by preoperative irradiation; and (5) the value of radiation therapy appears unrelated to the histologic type. (auth)

Vertebrates

Refer also to abstracts 6624, 6625, 6631, 6639, 6665, 6815, 6849, c d 6855.

67 (BNL-19557) RADIATION CARCINOGENESIS, LABORATORY STUDIES. Shellabarger, C. J. (Brookhaven National Lab., Upton, N. Y. (USA)). 1974. 58p. (CONF-750128-2). Dep. NTIS $6.00.

From symposium on delayed consequences of cancer therapy; Orlando, Florida, USA (9 Jan 1975).

Laboratory studies on radioinduced carcinogenesis are reviewed. Some topics discussed are: radioinduced neoplasia in relation to life shortening; dose-response relationships; induction of skin tumors in rats by alpha particles and electrons; effects of hormones on tumor response; effects of low LET radiations delivered at low dose-rates; effects of fractionated neutron radiation; interaction of RBE and dose rate effects; and estimates of risks for humans from animal data. (HLW)

6715 (BNL-19951) MODIFYING FACTORS IN RAT MAMMARY GLAND CARCINOGENESIS. Shellabarger, C. J. (Brookhaven National Lab., Upton, N. Y. (USA)). 1975. 27p. (CONF-750443-2). Dep. NTIS $4.50.

From conference on the biology of radiation carcinogenesis; Gatlinburg, Tennessee, USA (7 Apr 1975).

The spontaneous incidence of mammary adenocarcinomas and mammary fibroadenomas in rats was found to be related to the strain of rat studied. Strains of rats that are sensitive to chemical carcinogens in regard to induced mammary neoplasia tend to be the same strains of rats that are sensitive to radiation. Methylcholantrene (MCA) and x-rays appeared to act in an additive fashion on the induction of mammary adenocarcinomas when they were given together. Lactating and older rats lose responsiveness to chemical carcinogens but do not lose responsiveness to radiation. Radiation appears to act in a scopal fashion in the induction of mammary neoplasia. Mammary neoplasia induction was not changed when low LET radiation was split into 2 equal fractions and high LET radiation was more effective than low LET radiation in inducing mammary neoplasia. It is suggested that DMBA can act as an initiator for the induction of mammary adenocarcinomas, that phorbol can act as a promotor, and that viruses may induce mammary neoplasia. Diethylstilbestrol (DES) and radiation appeared to act synergistically in the induction of mammary adenocarcinomas in one strain of rat but not in another strain. (auth)

6716 (COO-2000-117) LOW-LEVEL X-IRRADIATION OF THE BRAIN DURING DEVELOPMENT: MORPHOLOGICAL, PHYSIOLOGICAL, AND BEHAVIORAL CONSEQUENCES. Progress Report, September 1, 1974–August 31, 1975. Altman, J. (Purdue Univ., Lafayette, Ind. (USA)). 1975. Contract AT(11-1)-2000. 15p. Dep. NTIS $4.00.

Progress is reported on studies on the effects of exposure to low-dose x radiation on the developing brain of rats. Brief summaries of results of morphological, physiological, and behavioral studies on rats exposed using various x-irradiation schedules are included. A list of papers published and submitted for publication during the period is included. (CH)

6717 (ERDA-tr-1) RADIOBIOLOGY. Translation of Radiobiologiya; 14: No. 5, 643-800(1974). 193p. Dep. NTIS $7.60.

Separate abstracts were prepared for the 42 papers contained in this issue. (ERB)

For abstracts of individual papers see: 6621–6625, 6635, 6643, 6651–6653, 6668, 6718–6746, 6797, and 6798.

6718 (ERDA-tr-1, pp 1-5) CHANGES IN THE STATE OF THE DNP OF THE NUCLEI OF SPERMATOGENIC CELLS, CAUSED BY RADIATION. Stakanov, V. A.; Kondratenko, V. G.; Kuzin, A. M. (Inst. of Biological Physics, Pushchino, USSR). May 1975. Translated from Radiobiologiya; 14: No. 5, 643-646 (1974).

In radiobiology.

The state of the DNP of the nuclei of irradiated spermatogenic cells of noninbred white mice was studied by the method of cytofluorimetry after whole-body irradiation at doses of 25, 50, 100, and 400 R. An analysis of the nuclei of spermatogonia, spermatocytes, and spermatids–cells differing in functional activity of the genome and in radiosensitivity–showed that the change in the state of their DNP after irradiation is similar at different levels of differentiation and depends on the structuro-functional peculiarities of the initial state. (tr-auth)

6719 (ERDA-tr-1, pp 11-16) COMPARATIVE ANALYSIS OF THE CONTENT OF DNA AND HISTONE FRACTIONS IN DNP AND SALT EXTRACTS OF THE RAT THYMUS AFTER GAMMA IRRADIATION, ADMINISTRATION OF DEGRANOL AND HYDROCORTISONE. Vodolazskaya, N. A.; Ermolaeva, N. V. May 1975. Translated from Radiobiologiya; 14: No. 5, 651-655(1974).

In radiobiology.

The histone/DNA ratio and fractional composition of the histones in preparations of DNP isolated from the rat thymus 6 hrs after γ irradiation at a dose of 600 R, or the introduction of degranol or hydrocortisone (10 mg/100 g), does not differ from the control. In salt extracts obtained after the indicated influences, the histone/DNA ratio was only negligibly lowered in comparison with DNP. No significant loss of any of the histone fractions or traces of their degradation were detected. The appearance of fragments of DNP with a changed histone/DNA ratio in comparison with DNP was demonstrated in salt extracts by the method of chromatography on cellulose phosphate and gel filtration on sepharose 4B. (tr-auth)

6720 (ERDA-tr-1, pp 32-36) STUDY OF THE HETEROGENEITY AND CERTAIN KINETIC PARAMETERS OF RAT BLOOD CATALASE IN THE DYNAMICS OF ACUTE RADIATION SICKNESS. Komov, V. P.; Strelkova, M. A. (Chemico-Pharmaceutical Inst., Leningrad). May 1975. Translated from Radiobiologiya; 14: No. 5, 669-672(1974).

In radiobiology.

The change in the differential activity and certain kinetic parameters of the catalase of rat blood erythrocytes in the normal state and in the dynamics of acute radiation sickness was studied. A pronounced change in the chromatographic, electrophoretic, and kinetic properties of isomeric forms of rat blood catalase in the development of radiation sickness was demonstrated. (tr-auth)

6721 (ERDA-tr-1, pp 37-41) INTERTISSUE EXCHANGE OF SEROTONIN AFTER THE INTRODUCTION OF RADIOPROTECTORS AND ITS POSSIBLE SIGNIFICANCE FOR RADIORESISTANCE. Kulinskii, V. I.; Cherkasova, T. I. (Krasnoyarsk Medical Inst., USSR). May 1975. Translated from Radiobiologiya; 14: No. 5, 673-676(1974).

In radiobiology.

High concentrations of serotonin (S) were detected in the bone marrow and lymphoid tissue of mice of various lines. Cystamine (CA) induces hyperserotoninemia and an accumulation of S in the spleen, while in mice of the CBA line there is an accumulation in the bone marrow as well. The administration of the minimum radioprotective doses of exogenous S leads to a substantial accumulation of it in the hematogenic and immunocompetent tissues. The transport of exo- and endogenous S into the hematogenic tissues and its influence on them is probably an important factor in the mechanism of the radioprotective effect (RPE). (tr-auth)

6722 (ERDA-tr-1, pp 42-46) SOMATIC AND GENETIC LESIONS CAUSED BY FRACTIONATED X IRRADIATION AND AN ATTEMPT AT CHEMICAL RADIOPROTECTION. Baev, I. A.; Bairakova, A. K.; Benova, D. K. (Scientific Research Inst. of Radiobiology and Radiation Hygiene, Sofia). May 1975. Translated from Radiobiologiya; 14: No. 5, 677-680(1974).

In radiobiology.

The mortality, fertility, and first progeny were studied for female rats irradiated fractionally at a dose of 800 R of x rays (20 days, 40 R per session). The detected somatic and genetic lesions caused by fractionated irradiation were not modified by cysteamine and cystamine. (tr-auth)

6723 (ERDA-tr-1, pp 53-57) INFLUENCE OF CERTAIN BIOLOGICALLY ACTIVE PREPARATIONS ON THE POPULATION OF HEMATOGENIC STEM CELLS AND ON THE SURVIVAL OF IRRADIATED MICE. Communication 2. Polyinosinic–Polycytidylic Acid. Semina, O. V.; Konoplyannikov, A. G.; Poverennyi, A. M. (Scientific Research Inst. of Medical Radiology, Obninsk, USSR). May 1975. Translated from Radiobiologiya; 14: No. 5, 686-689(1974).

In radiobiology.

It was shown on mice of the CBA line and noninbred mice that intraperitoneal administration of 0.05 mg polyinosinic-polycytidylic acid two days before irradiation leads to an increase in the yield of spleen endocolonies and to an increase in the survival of the irradiated mice. The observed effects are evidently associated with the ability of this preparation to increase the fraction of hematogenic stem cells. (tr-auth)

6724 (ERDA-tr-1, pp 58-63) INFLUENCE OF POST-RADIATION HYPEROXIA AND HYPOXIA ON THE MORTALITY OF RATS IRRADIATED WITH X RAYS. Sizenko, S. P.; Rudakov, N. P.; Ivanov, I. F. (Kiev Roentgenoradiological and Oncological Scientific Research Inst., Kharkov). May 1975. Translated from Radiobiologiya; 14: No. 5, 690-694(1974).

In radiobiology.

In the case of irradiation of rats at doses of 300 to 1000 rad, followed by their maintenance under conditions of hyperoxia or hypoxia, it was established that at doses less than $LD_{50/30}$, an excess of oxygen slows down the rate of formation of radia-

tion damages, while a deficiency of it accelerates it. With variation of the dose, such an effect of oxygenation and hypoxia is gradually leveled out, while at doses exceeding $LD_{50/30}$ the investigated factors have the opposite effect. (tr-auth)

6725 (ERDA-tr-1, pp 64-69) INFLUENCE OF PRELIMINARY ADMINISTRATION OF DNA ON THE FREQUENCY OF RADIATION DAMAGES TO CHROMOSOMES. Nikolaevskaya, N. G.; Muksinova, K. N. May 1975. Translated from Radiobiologiya; 14: No. 5, 695-699(1974).

In radiobiology.

Radiation damages to the chromosomes of bone marrow cells of rats that received high-polymer homologous DNA 3 hrs before irradiation at doses of 100 and 300 R were studied. Preliminary administration of DNA provided for a more pronounced decrease in the frequency of chromosome aberrations than when it was used after irradiation. (tr-auth)

6726 (ERDA-tr-1, pp 75-80) AGE PECULIARITIES OF CHANGES IN THE CRYSTALLINE LENS OF MICE UNDER THE ACTION OF EXTERNAL BETA IRRADIATION. Milovidova, I. A. May 1975. Translated from Radiobiologiya; 14: No. 5, 705-709(1974).

In radiobiology.

It was shown on six and 30-week-old rats that the cells of the crystalline lens of young animals are more sensitive to whole-body β irradiation, and the degree of change in the crystalline lens depends on the dose of irradiation. (tr-auth)

6727 (ERDA-tr-1, pp 81-85) RELATIONSHIP OF THE CHANGES IN THE ELECTRICAL ACTIVITY AND CONTENT OF FREE AMINO ACIDS OF THE BRAIN OF WHITE RATS IN THE CASE OF WHOLE-BODY X IRRADIATION. El-Koshef, H. S. (Inst. of Atomic Energy, Cairo). May 1975. Translated from Radiobiologiya; 14: No. 5, 710-714(1974).

In radiobiology.

The shifts in the EEG of the brain, occurring during the first 4 hrs after irradiation of rats at a dose of 100 R, were of the nature of an increase in the slow waves, when the content of γ-aminobutyric acid (GABA) increased, while at a dose of 600 R there was a predominance of the rapid portion of the EEG spectrum and a decrease in the content of GABA. This is evidence of the role of GABA as an inhibitory mediator. Moreover, a relationship was detected between the dynamics of the content of glutamic acid and the summary power of the entire EEG spectrum, which evidently reflects a definite relationship of it to the metabolic basis of processes of electrogenesis. (tr-auth)

6728 (ERDA-tr-1, pp 86-91) INFLUENCE OF HUMORAL FACTORS FROM THE CALF THYMUS ON THE IMMUNOLOGICAL STATUS AND PROCESSES OF HEMATOGENESIS OF THE IRRADIATED ORGANISM. Communication 1. Influence of Injections (Preliminary Before Irradiation) of the Factor from the Thymus (TF-3) on Certain Indices of the Immune System of Irradiated Mice. Skobel'tsyna, E. S.; Vasil'chenko, V. N.; Grinberg, S. M.; Samuleva, S. V.; Stolyarova, T. V.; Goncharko, O. Yu. (Scientific Research Inst. of Medical Radiology, Kharkov). May 1975. Translated from Radiobiologiya; 14: No. 5, 715-719 (1974).

In radiobiology.

It was shown in experiments on mice that irradiation (450 R), performed 4 hrs before immunization, leads to a significant decrease in the number of plaque-forming cells in the spleen, detectable on the fifth day after immunization. Animals that received three injections of the preparation from the thymus (TF-3) before irradiation had 2 to 12 times as many plaque-forming cells (PFC) per 10^6 nucleated cells (NC) in comparison with a group of mice that received three injections of physiological solution before irradiation. (tr-auth)

6729 (ERDA-tr-1, pp 92-97) INFLUENCE OF CHRONIC IRRADIATION IN LOW DOSES ON SEX DIFFERENCES IN THE RADIOSENSITIVITY OF WHITE MICE. Lisenkova, L. N. (Scientific Research Inst. of Radiation Hygiene, Leningrad). May 1975. Translated from Radiobiologiya; 14: No. 5, 720-724 (1974).

In radiobiology.

Sex differences in the radiosensitivity of white mice, chronically irradiated at doses of 6, 17, and 50 mR/day, were studied. Greater radioresistance of the females was established in comparison with the males. Under the influence of the conditions of irradiation used, the sex differences in radioresistance are enhanced. (tr-auth)

6730 (ERDA-tr-1, pp 98-103) ENDOTOXEMIA OF LETHALLY IRRADIATED ANIMALS. Meter, I. D. (Central Roentgenoradiological Scientific Research Inst., Leningrad). May 1975. Translated from Radiobiologiya; 14: No. 5, 725-729(1974).

In radiobiology.

A toxic substance, evidently an endotoxin of Gram-negative bacteria, the amount of which is significantly increased by the third day after irradiation of animals at a dose of 1300 rad, was detected with the aid of Actinomycin D in the blood of lethally irradiated mice. The increase in toxicity coincides in time with the increase in permeability of the intestinal wall of bacterial lipopolysaccharides, which we had established earlier. (tr-auth)

6731 (ERDA-tr-1, pp 104-107) DNA-DEPENDENT RNA POLYMERASE OF THE ORGANS OF IRRADIATED ANIMALS. Communication 3. RNA Polymerase Metabolism in the Liver and Spleen. Likhoded, V. S.; Paskevich, I. F. (Scientific Research Inst. of Medical Radiology, Kharkov). May 1975. Translated from Radiobiologiya; 14: No. 5, 730-733(1974).

In radiobiology.

A study of the metabolism of RNA polymerase during irradiation is of great interest both from the standpoint of elucidating the synthesis of the enzyme and from the standpoint of the comparison of these data with the results on the change in processes of transcription and the role of RNA polymerase in these disorders. (tr-auth)

6732 (ERDA-tr-1, pp 119-123) PECULIARITIES OF THE CHANGES IN THE DNA METABOLISM IN THE BONE MARROW AND SMALL INTESTINE UNDER CONDITIONS OF NONUNIFORM IRRADIATION. Titov, A. V.; Golubentsev, D. A.; Mordukhovich, V. V. (Military-Medical Academy, Leningrad). May 1975. Translated from Radiobiologiya; 14: No. 5, 742-745(1974).

In radiobiology.

In experiments on 160 male rats, the DNA content and the rate of its biosynthesis in the tissues of the bone marrow and small intestine were studied in the presence of radiation lesions induced by nonuniform irradiation (nonuniform whole-body irradiation, irradiation only of the anterior or posterior half of the body). The control data were obtained for whole-body uniform irradiation. The radiation doses used were equieffective, judging by the mortality of the animals. It was shown that radiation damage to the bone marrow and intestines is associated chiefly with the direct action of radiation on these tissues. The remote action is of secondary significance in the realization of the injurious action of radiation. (tr-auth)

6733 (ERDA-tr-1, pp 124-127) POSTRADIATION RECOVERY OF THE CHROMOSOMES OF SOMATIC CELLS OF MAMMALS. Influence of Thyroxin on Oxidative Phosphorylation and the Frequency of Chromosome Aberrations in Rat Liver Cells. Antipenko, E. N.; Stetsenko, I. P.; Yudin, G. I. (Kiev Roentgenoradiological and Oncological Scientific Research Inst., Kharkov). May 1975. Translated from Radiobiologiya; 14: No. 5, 746-749(1974).

In radiobiology.

The relationship of the effects of thyroxin, reducing the number of aberrant cells in the regenerating liver with oxidative phosphorylation, was studied, and the period of formation of the detected radioprotective effect of the hormone was refined. Results were obtained supporting the assumption that thyroxin can stimulate postradiation recovery of the chromosomes. (tr-auth)

6734 (ERDA-tr-1, pp 128-130) PROTECTIVE EFFECT OF DITHIOTHREITOL ON THE PHOSPHORYLATION OF HISTONE F_1 UNDER THE INFLUENCE OF X RAYS. Nikolova, R. Kh.; Dancheva, K. Iv. (Central Lab. of Electron Microscopy, Sofia). May 1975. Translated from Radiobiologiya; 14: No. 5, 749-751(1974).

In radiobiology.

The protective effect of dithiothreitol, as a S-S compound, on the phosphorylation of histone F_1 under the influence of x rays (100 R) was studied using thymocyte suspensions. It was concluded from the experimental results that dithiothreitol is a radioprotector with respect to the process of phosphorylation of the histone F_1 in the thymocytes. (ERB)

6735 (ERDA-tr-1, pp 131-134) INFLUENCE OF A PREPARATION OF MIGI-K ON THE CONTENT OF CERTAIN ENDOGENOUS RADIOPROTECTORS AND RADIOSENSITIZERS IN RAT TISSUES. Goncharenko, E. N.; Deev, L. I.; Karagodin, V. P.; Kudryashov, Yu. B. (Moscow State Univ.). May 1975. Translated from Radiobiologiya; 14: No. 5, 752-754(1974).

In radiobiology.

A comparative study was conducted of the influence of the radioprotective preparation MIGI-K (it contains vitamins, trace elements, and amino acids and the protector β-mercaptoethylamine (MEA) on the level of endogenous radioprotective substances (serotonin and dopamine) and the level of endogenous radiosensitizers (peroxides of unsaturated fatty acids) in various tissues of animals. The data obtained permit the conclusion that certain characteristic changes in the biochemical background (increase in the content of serotonin and dopamine, decrease in

the content of lipid oxidation products) are observed not only after the administration of protectors of the class of aminothiols and indolylalkylamines, but are also possible under the action of other radioprotective agents, in particular, of the complex of vitamins, trace elements, and amino acids of the preparation MIGI-K studied. (ERB)

6736 (ERDA-tr-1, pp 139-142) RELATIONSHIP OF HYPERCORTICISM INDUCED BY CYSTAMINE TO THE TOXIC AND RADIOPROTECTIVE EFFECTS OF THIS RADIOPROTECTOR. Glinik, A. D.; Zherebchenko, P. G.; Kalistratov, G. V.; Romashko, O. O. May 1975. Translated from Radiobiologiya; 14: No. 5, 758-760(1974).

In radiobiology.

Sulfur-containing protectors and indolylalkylamines induce an increase in the activity of the pituitary-adrenal system in animals, but there is no information in the literature on the dependence of the hypercorticism that develops on the dose of the radioprotectors. Moreover, it is unclear whether the active function of the adrenals is associated with the radioprotective or with the toxic effect of the substance introduced. The present investigation was devoted to the elucidation of these questions. We showed earlier that benzonal can significantly reduce the toxicity of cystamine, without affecting its radioprotective activity. If the activation of the pituitary-adrenal system actually is responsible for the radioprotective effect, then benzonal should not lower its level. The presence of such an influence of benzonal, on the other hand, would permit a conclusion to be drawn on the relationship of the hypercorticism, occurring after the administration of cystamine, to the toxicity of the latter, and not its radioprotective activity. It was found that benzonal reduces the activation of the function of the adrenals caused by low doses of cystamine and its toxicity to approximately the same degree. At the same time, benzonal has no influence on the radioprotective effect of cystamine, used in the same dose. It can be assumed that the hypercorticism observed in animals after the administration of this disulfide is due to its toxic effect, and evidently is not related to the state of increased radioresistance created by it. (ERB)

6737 (ERDA-tr-1, pp 143-145) INFLUENCE OF WHOLE-BODY EXTERNAL BETA IRRADIATION ON THE COMPOSITION OF THE PERIPHERAL BLOOD OF RATS OF THE WISTAR LINE, 14 AND 30 DAYS OLD. Smirnov, A. V.; Petrovich, I. K. May 1975. Translated from Radiobiologiya; 14: No. 5, 761-763(1974).

In radiobiology.

The effects of whole-body external β irradiation on the morphological composition (erythrocytes and leukocytes) of the peripheral blood of young rats as a function of age were investigated. Based on the experimental results, the following conclusions were made. Leukocytosis, noted 7 to 14 days after irradiation in young rats of both ages, evidently is associated with inflammatory phenomena in the skin, since it is of a pronounced neutrophil nature. Moreover, the sharp increase in the number of leukocytes coincides in time with the maximum skin reactions in the young rats. The number of erythrocytes in the blood of the young rats at various periods after irradiation was essentially unchanged; nor were there any significant differences in the number of erythrocytes in comparison with the initial level and with the control. Consequently, the state of the white blood cells can serve as an indices of the severity of radiation sickness after external β irradiation. (ERB)

6738 (ERDA-tr-1, pp 149-153) RADIOPROTECTIVE ACTION AND TOXICITY OF CERTAIN SUBSTITUTED BENZO-2,1,3-THIADIAZOLES. Vladimirov, V. G.; Strel'nikov, Yu. E.; Belen'kaya, I. A.; Kostruukovskii, Ya. L.; Tsepova, N. S. (Military Medical Academy, Leningrad). May 1975. Translated from Radiobiologiya; 14: No. 5, 766-770(1974).

In radiobiology.

Among the derivatives of benzo-2,1,3-thiadiazole that we have synthesized, a number of preparations exhibiting a rather high radioprotective effect have been detected. Special attention has been attracted by 4-hydroxy-5-methylbenzo-2,1,3-thiadiazole, which was equal to the radioprotective action of such a well-known protector as cystamine in experiments on mice. At the same time, 4-hydroxy-5-methylbenzo-2,1,3-thiadiazole did not exhibit any significant advantages over cystamine. In particular, to obtain a high radioprotective effect of it, just as for aminothiol protectors, it was necessary to administer it in rather large doses. Moreover, the preparation is poorly soluble in water. In view of this, it seemed advisable to continue the synthesis of new derivatives of benzo-2,1,3-thiadiazole in order to obtain preparations more suitable for use in practical medicine. The experiments were conducted on white mice weighing 18 to 20 g. The radioprotective activity of the substances was judged according to the survival of the animals up to 30 days after their irradiation with γ rays on an EGO-2 apparatus at a dose of 750 R (LD = 95). The dose rate was 95 R/min. The preparations were administered intraperitoneally at the maximum tolerable doses 30 min before irradiation. At the same time, the toxicity of the preparations (LD_{50}) was evaluated, also in the case of intraperitoneal administration. (tr-auth)

6739 (ERDA-tr-1, pp 154-156) USE OF PROTEOLYTIC ENZYMES TO PREVENT THE CONSEQUENCES OF IONIZING RADIATION IN ANIMALS IRRADIATED DURING THE PRENATAL PERIOD. Uspenskii, Yu. N.; Gendzelevskaya, Z. N.; Goryacheva, I. A. (Main Military Hospital, Moscow). May 1975. Translated from Radiobiologiya; 14: No. 5, 770-773(1974).

In radiobiology.

It was established that the irradiation of pregnant rats can lead to stillbirths or nonviability of the offspring, as well as to various anomalies of development and deformities. To prevent the indicated consequences of ionizing radiation, in this work we tested the action of proteolytic substances (pancreatin, trypsin, and chymotrypsin) in various doses and combinations. Analyzing the data obtained, we can draw the following conclusions: the highest viability was noted in progeny that received the complete complex of the indicated proteolytic enzymes (trypsin, chymotrypsin, and pancreatin) per os from the day of pregnancy of the mother and during the entire prenatal period. When the rats were fed only chymopsin and trypsin (also from the day of pregnancy of the mother and subsequently to the offspring with the water or milk), lower viability was noted. When the rats were fed only pancreatin from the day of pregnancy, a still lower viability was noted in the progeny than in the second group, although no defects of development were observed in this case. (ERB)

6740 (ERDA-tr-1, pp 157-160) RADIOPROTECTIVE PROPERTIES OF YEAST POLYSACCHARIDE. Rogozkin, V. D.; Andrianova, I. E.; Razorenova, V. A.; Vitovskaya, G. A.; Elinov, N. P. (Inst. of Biophysics, Moscow). May 1975. Translated from Radiobiologiya; 14: No. 5, 773-776(1974).

In radiobiology.

The possible radioprotective properties of yeast polysaccharide were studied in γ-irradiated mice. Under the conditions of the experiment (600 and 700 R irradiation and intraperitoneal administration of preparations), no significant effects from the use of polysaccharides after irradiation were detected. In experiments on guinea pigs, a significant protective effect was found at radiation doses of 450 R. (ERB)

6741 (ERDA-tr-1, pp 161-163) INFLUENCE OF IRRADIATION AND SUBSEQUENT TRANSPLANTATION OF BONE MARROW ON THE FORMATION OF SERUM AND CELLULAR INTERFERON IN MICE. Mentkevich, L. M.; Shcheglovitova, O. N. (Inst. of Epidemiology and Microbiology, Moscow). May 1975. Translated from Radiobiologiya; 14: No. 5, 776-778(1974).

In radiobiology.

The purpose of the present investigation was to study the influence of the most frequent type of bone marrow transplantation, namely, syngenic transplantation, on the formation of serum and cellular interferon, induced by interferonogens with different types of action. Analyzing the data obtained, it can be assumed that the reduced formation of serum interferon in syngenic chimeras is due to a decrease in the number of cells of the blood and hematogenic organs, as well as other, still unidentified cells, which participate in its formation. The existence of cells of this kind is demonstrated by the different sensitivity of the production of serum interferon to irradiation and the action of antilymphocytic serum, as well as the formation of the recipient-type interferon in xenogenic chimeras. It may also be that inhibitors of interferon formation are accumulated in the bodies of irradiated animals. (ERB)

6742 (ERDA-tr-1, pp 164-166) INFLUENCE OF FORMALDEHYDE ON THE COURSE AND OUTCOME OF ACUTE RADIATION SICKNESS. Kolesnikov, P. A. May 1975. Translated from Radiobiologiya; 14: No. 5, 778-781(1974).

In radiobiology.

Experiments were conducted using x-irradiated mice to determine the effects of formaldehyde inhalation on the course and outcome of radiation sickness. These parameters were judged according to the change in body weight and death of animals for 30 days. The content of SH groups in the blood and liver catalase were also investigated. The results indicate that formaldehyde increases the sensitivity of the mice to irradiation. The sensitizing effect was demonstrated for up to 5 days following the influence. Investigation of the content of sulfhydryl groups in the blood of mice after an inhalation influence of formaldehyde showed a decrease in their content in the blood. Thus, after the influence of formaldehyde the content of SH groups in the blood of the animals was lowered to 670 ± 20 μmoles/100 ml in comparison with 800 ± 32 μmoles/100 ml in the control ($P = 0.03$). The activity of liver catalase was significantly lowered on the fifth day after the influence of formaldehyde ($P = 0.05$). Thus, a preliminary

inhalation action of formaldehyde on mice aggravates the course and outcome of radiation sickness. The data obtained on the decrease in radioresistance after treatment with formaldehyde against a background of the reduction of the content of sulfhydryl groups in the control and the activity of liver catalase of the animals agree with the corresponding hypotheses on the nature of the radiosensitivity. (ERB)

6743 (ERDA-tr-1, pp 167-169) STATE OF THE BONE MARROW IN DOGS IN THE LONG-TERM PERIODS AFTER TWO IRRADIATIONS WITH HIGH-ENERGY PROTONS UNDER CONDITIONS OF LOCAL SHIELDING OF THE BODY. Kalandarova, M. P. May 1975. Translated from Radiobiologiya; 14: No. 5, 781-783(1974).

In radiobiology.

The study of hemopoiesis in the long-term periods after a radiation influence is of substantial interest, since it permits an evaluation of the general trend of recovery processes, the degree of compensation in the hematogenic organs, as well as the detection of a defect of repair. The present investigation is devoted to a study of changes in the bone marrow in the case of two irradiations with 250 MeV protons. The experiment was conducted on 18 dogs, irradiated twice at a dose of 350 rad (at 45-day intervals) with shielding of various parts of the body: head, thorax, upper portion of the abdomen, pelvic region. The dose of radiation, 350 R, in this experiment was the minimum absolutely lethal dose under condition of uniform whole-body irradiation. Considering the fact that for a number of dogs the thorax or pelvic region was shielded during irradiation, we simultaneously conducted a dynamic investigation of the bone marrow of the sternum and the ilium 1.5-3.5 years after the influence. The results of the investigations are evidence that 1.5 to 3.5 years after two radiation influences, the hematogenesis was reduced in all the dogs. Moreover, certain differences could be noted in the picture of the bone marrow, depending to a definite degree on the size of the region of the organ protected during irradiation, regardless of its localization. Phenomena of hypoplasia in dogs irradiated with shielding of 5% of the bone marrow (protection of the upper part of the abdomen) were more pronounced and developed more rapidly than in animals irradiated under conditions of shielding of 9 to 15% of the bone marrow (shielding of the heat, thorax, and pelvis). (tr-auth)

6744 (ERDA-tr-1, pp 170-172) USE OF CHICKENS AS A RADIOBIOLOGICAL MODEL. Kusurova, Z. G.; Loskutova, Z. F. May 1975. Translated from Radiobiologiya; 14: No. 5, 783-785 (1974).

In radiobiology.

Up to the present time, experiments on birds of various species for the investigation of questions in the field of the study, prophylaxis, and therapy of radiation sickness have not found wide use. This model should attract attention, since the presence of poultry production for purposes of the national economy makes it possible to obtain a sufficient number of inexpensive organisms of standard weight, sex, and age. For the use of chickens in radiobiological experiments it was necessary to study the peculiarities of the course of acute radiation sickness and survival in them. Leukocyte counts and erythrocyte counts were also obtained as a function of radiation dose as well as the chicken's resistance to infection. On the basis of these investigations, the following conclusions were drawn. The monotypic nature of the course of the process of radiation sickness, the distinct dependence of the rate of recovery processes on the dose of irradiation indicate the advisability of using birds for the study of various problems in radiobiology. It is convenient to evaluate the resistance to infection on the basis of a determination of the number of microbes of the autoflora on the skin of the comb. (ERB)

6745 (ERDA-tr-1, pp 173-174) METHODS OF MATHEMATICAL ANALYSIS OF THE DYNAMICS OF THE LEUKOCYTES IN THE CASE OF NONUNIFORM IRRADIATION OF ANIMALS. Barsov, P. A.; Sakovich, V. A.; Yurgov, V. V. May 1975. Translated from Radiobiologiya; 14: No. 5, 785-787(1974).

In radiobiology.

The evaluation of the effectiveness of irradiation influence in the case of nonuniform extensive irradiation is a problem of practical importance, but still unsolved. The method of the "reduced" dose, in which the value of the dose of total uniform irradiation, inducing the same quantitative manifestation of the biological effect as in the case of nonuniform irradiation, is used, may be rather promising. In the range of doses for which the critical organ is the bone marrow, the survival of bone marrow cells, averaged over the whole organism, is taken as the biological effect. On account of methodological difficulties, the dependence of this effect on the dose has been obtained only for small laboratory animals. In this work the indicated dependence was calculated for dogs on the basis of a model description of the dependence of the number of leukocytes in the peripheral blood on the number of surviving bone marrow cells after acute irradiation. The procedure developed permits the use of the "reduced" dose as the criterion of radiation influence for the results of observations obtained, for example, in therapeutic local irradiation. (ERB)

6746 (ERDA-tr-1, pp 178-182) CRITICAL PERIODS OF DEATH OF RATS AS A FUNCTION OF THEIR AGE AND THE DOSE OF IRRADIATION. Kholin, V. V. (Leningrad State Inst. for the Advanced Training of Physicians). May 1975. Translated from Radiobiologiya; 14: No. 5, 789-793(1974).

In radiobiology.

The dependence of the periods of death of rats on the age in the case of irradiation within a broad range of doses was studied. In contrast to the generally accepted criterion on average lifetime, in this work we estimated the percent death of the animals at the corresponding days. In the case of irradiation at doses above 10 kR, a shift toward early death of young growing animals, primarily nurselings, was observed. Consequently, the age determination of the periods of death cannot simply be taken as an increase in the frequency of lethal results with decreasing age of the animals. There is a complex pathogenetic relationship between the level of maturity of the animals, the dose of the radiation influence, and the periods of death. The experimental data cited not only show a significant dependence of the peculiarities of death of the rats on the age within a broad range of doses, but also give grounds for believing that in a number of cases these differences are based on substantial pathogenetic peculiarities in the course of the radiation sickness itself, leading to differences in the direct cause of death. (tr-auth)

6747 (LF-49, pp 182-185) EFFECT OF ACUTE ^{60}Co EXPOSURE OR CONTINUOUS INTAKE OF TRITIATED WATER ON THE LIVER CHROMOSOMES OF HALE-STONER BROOKHAVEN MICE. Brooks, A. L.; Carsten, A. L.; Mead, D. K.; Reterford, J. C. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973-1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

Chromosomal damage in the livers of mice exposed to acute ^{60}Co irradiation or continuous intake of tritiated water (HTO) was evaluated and compared with that observed in livers of Chinese hamsters subjected to various modes of irradiation. One group of 30 Hale-Stoner Brookhaven mice was exposed to a graded series of acute ^{60}Co exposures and a second group of 55 was maintained on water with 3 mu Ci of tritiated water/ml for 90, 330, (500, 560), or 700 days. The experimental animals and age-matched controls were partially-hepatectomized to stimulate liver cell division and the frequency of chromosome aberrations in metaphase cells of the liver used as an index of radiation-induced change. When liver cell chromosomes from mice on HTO water were compared to age-matched controls, there was a higher level of damage in the animals on HTO at each sampling time. At the 5 percent level, however, the increase was not statistically significant. When four animals were omitted from the data (one with a clone of abnormal cells and three with an unusual distribution of chromosome damage), there was a significant increase in the level of chromosome damage in the liver of mice on HTO for either 330 or (550, 560) days. The level of chromosome damage following HTO ingestion was similar on a per rad basis to that seen in Chinese hamster livers after protracted ^{60}Co gamma exposure or internally deposited ^{144}Ce, an energetic beta emitter. The data support the concept that on a per rad basis, the risk for chromosome breakage following tritium exposure as HTO is similar to that from other beta-gamma emitters. (auth)

6748 (LF-49, pp 261-264) SPONTANEOUSLY OCCURRING RENAL DISEASE IN THE SYRIAN HAMSTER. Slauson, D. O.; Hobbs, C. H. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973-1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

Syrian hamsters develop spontaneous renal lesions that resemble those of arteriolar nephrosclerosis in man and differ from other spontaneously occurring or virus-induced renal diseases previously observed in other rodent species. The morphologic changes are degenerative and inflammatory but with little cellular infiltration, and are associated with histopathologic changes in the intrarenal vasculature. The lesions are progressive, often fatal, and are not uncommonly complicated by glomerular amyloidosis or membranous glomerulonephritis with the nephrotic syndrome and uremia. End stage kidneys often exhibit fibrinoid necrosis of intrarenal arterioles and thus resemble lesions seen in the malignant phase of human essential hypertension. The pathologic changes appear at an earlier age and are often more severe in females than in males, are a major cause of morbidity and mortality, and hamper life-span studies utilizing the hamster. Further, when uremia is present, the histopathologic

changes of uremic pneumonitis are difficult to separate from those of radiation-induced pneumonitis. (auth)

6749 (NIRS-R-1, pp 4-15) STUDIES ON THE ANALYSIS OF H-2 ALLOANTIGENS AND THE RADIATION CHIMERA INDUCED BY ALLOGENEIC BONE MARROW TRANSPLANTATION. Tamanoi, I.; Dei, T.; Tsuchiya, T.; Tachibana, T.; Tanaka, T. Oct 1973. (In Japanese).

In fundamental and clinical aspects of bone marrow transplantation in April 1970–March 1973. Final Report. (National Inst. of Radiological Sciences, Chiba (Japan)).

The aim of our present report is to pursue the factors which determine whether allogeneic bone marrow transplantation after whole-body irradiation with lethal doses leads animals to the death by secondary disease or midlethal dose effect, or to the survival by the induction of radiation chimera. The difference of histocompatibility antigens in CF#1/Nrs from C57BL/6j (H-2^b) was examined first by skin grafting and serological tests such as cytotoxic test, mixed hemadsorption test, immune adherence test, and hemagglutination test. In the subsequent experiments, CF#1/Nrs as host was irradiated with 900 or 605 R ($LD_{90/30}$) and transplanted C57BL/6j bone marrow in the next day of irradiation. In the bone marrow transplantation with 25×10^6 of nucleated cells, 85% of the 605 R group was dead by 20 days, while 85% of the 900 R group survived until 50 days. When EL-4 tumor cells originated from C57BL were inoculated to the survivors, EL-4 cells proliferated linearly and animals were dead finally, in spite of the fact that syngeneic bone marrow transplanted animals rejected EL-4 completely. Furthermore, both skin grafts from donor and host strains on the survivors were alive over 120 days until death or sacrifice for histological examination. Histological examination showed the extreme proliferation and thickening of mature collageneous tissue of dermis. By the indirect membrane fluorescent antibody method, the ratio of donor to host cells was examined in bone marrow and peripheral blood cells from the CF#1/Nrs, irradiated with 900 R or 605 R and transplanted with 25×10^6 of C57BL/6j bone marrow cells. In the last experiments, donor cells were examined in spleen, thymus, and mesenteric lymph node of CF#1/Nrs mice irradiated with 605 R and transplanted with C57BL/6j bone marrow cells (25×10^6). In the early stage, the failure of small lymphocytes and the occurrance of fibrosis was noted, and it was suggested that donor cells might recur from organ to organ with a time lag, and afterwards, proliferation occurred rapidly. The radiation chimera seemed to be induced by repeating the appearance of host cells with an increasing number every 3 weeks. (auth)

6750 (NIRS-R-1, pp 22-29) PREVENTION OF DEATH BY MICROBIAL RESTRICTION IN RADIATION CHIMERA WITH A STRONGLY HISTOINCOMPATIBLE COMBINATION. Yamaguchi, T.; Matsumoto, T.; Suzuki, J.; Tanaka, Y. Oct. 1973. (In Japanese).

In fundamental and clinical aspects of bone marrow transplantation in April 1970–March 1973. Final report. (National Inst. of Radiological sciences, Chiba (Japan)).

Effect of microbial restriction on the long term (270 days) survival of murine radiation chimera with a strongly histoincompatible combination was examined. Mortality of the conventional (CV) C57BL/6J (H-2^b, Hbb^s) mice transplanted with C3H/He (H-2^k, Hbb^D) bone marrow (BM) after a lethal irradiation (800 R of x-rays) was greatly reduced by increasing the number of BM cells from 5×10^6 to 15×10^6. Continuous administration of aureomycin further increased this improved survival rate (up to 40% at 120 days postirradiation). On the contrary, when the irradiated CV C3H mice were given C57BL BM, the survival time of the host injected with 15×10^6 cells was shorter than that with 5×10^6 cells. Aureomycin did not improve the survival rate. No mice survived 90 days postirradiation among more than 100 C3H hosts with C57BL BM. In the specific-pathogen-free mice, the allogeneic BM cells in a dose of 5×10^6 prevented completely the death of the irradiated (1000 R of γ-rays from ^{137}Cs) hosts in both strain combinations. Forty C3H hosts with C57BL BM have survived quite healthy 270 days postirradiation without any dead individual. Pre-immunization of recipients with donor spleen cells caused a fatal Host-versus-Graft reaction of SPF mice. A fatal Graft-versus-Host reaction of SPF was indicated in SPF recipients given allogeneic spleen cells. When the C3H recipients given C57BL BM were transferred from SPF to CV condition at various times after irradiation, the long term survival rate decreased markedly. The decrease in survival rate was also observed in unirradiated C3H mice or syngeneic bone marrow recipients. Decrease in survival of allogeneic chimera after transfer to CV, however, was greater than that in syngeneic recipients or unirradiated controls. Administration of aureomycin alleviated the long term survival after the transfer from SPF to CV condition. (auth)

6751 (NIRS-R-1, pp 30-39) IMMUNOLOGICAL STUDIES OF MOUSE RADIATION CHIMERAS. Relation of Immunological Status of the Host to the Manifestation of Secondary Disease. Sado, T.; Kobayashi, S.; Kamisaku, H.; Kurotsu, T. Oct 1973. (In Japanese).

In fundamental and clinical aspects of bone marrow transplantation in April 1970–March 1973. Final report. (National Inst. of Radiological Sciences, Chiba (Japan)).

All of the proliferating cells in the host spleens and bone marrow were donor derived at all time intervals after irradiation and bone marrow treatment. This was also true for those chimeric mice suffering from the severe secondary disease. This indicates that allograft failure (allograft resistance) or delayed rejection of the donor cells by the host cannot be the cause of the secondary disease. With all assay methods used, syngeneic mouse radiation chimeras restored their immune competence to a significant level by the end of the third week after irradiation. Suppression of the recovery of immune competence was demonstrated in thymectomized mice. But it was also shown that the recovery of B cells (precursor of antibody forming cells) proceeded at a normal rate under the athymic environment. Small reduction in the degree of antigenic disparity between graft donor and host improves the consequence of allogeneic bone marrow grafting. Secondary mortality due to allogeneic bone marrow grafting following lethal irradiation of the hosts was diminished when they were reared under the specific-pathogen-free environment. Spleen cell populations of allogeneic mouse radiation chimeras which were apparently tolerant to the host antigens contained immunocompetent clones reactive to the host antigens but were inhibited from acting in situ by an as yet unknown mechanism. Incidence of secondary mortality was not reduced by the removal of thymus derived cells from the treatment, suggestion that GVH reaction leading to the manifestation of secondary disease was likely to be caused by bone marrow derived B cells rather than by thymus derived T cells. Significance of these findings to the mechanisms of manifestation of secondary disease and of escape from it was discussed. (auth)

6752 (NIRS-R-1, pp 58-65) RECOVERY OF HAEMATOPOIETIC CELLS AFTER BONE MARROW TRANSPLANTATION IN TWO STRAINS OF MICE WITH DIFFERENT LD50(30). Tsuchiya, T.; Hayakawa, J.; Dei, T.; Tamanoi, I.; Teramoto, S. Oct 1973. (In Japanese).

In fundamental and clinical aspects of bone marrow transplantation in April 1970–March 1973. Final report. (National Inst. of Radiological Sciences, Chiba (Japan)).

It was attempted to clarify the cause of haematopoietic death from the aspect of transplanted bone marrow cell kinetics in the two strains of mice, C57BL/6JNrs and CF#1/Nrs, whose LD50(30) are 685 R and 510 R, respectively. The survival rates were observed under various radiation dose and the syngeneic bone marrow cell numbers. When the same lethal dose was given to these two strains of mice, CF#1 mice required about ten times as many cells as C57BL to show the same survival rate in both strains of mice. The estimated LD50(30) after bone marrow transplantation increased with increase of the number of transplanted cells in both strains, and when same numbers of cell were transplanted in each strain, the difference in LD50(30) between two strains persisted as in LD50(30) without transplantation. Based on the results, the recovery of bone marrow cells and peripheral blood cells were depicted with these two strains of mice. The cells in C57BL mice recovered more slowly than those of CF#1 mice. Bone marrow and splenic CFU and AASU (Alloantigen Sensitive Units) in spleen cells of host animal after bone marrow transplantation were evaluated to make the direct comparison of recovery of undifferentiated progenitor cells between these two strains. The CFU in CF#1 mice recovered faster than that in C57BL, whereas the AASU recovered more slowly than in C57BL. Finally, survival rate after reciprocal allogeneic bone marrow transplantation between these two strains of mice was evaluated. The CF#1 host mice showed strongly allograft resistance to C57BL donor cells but not vice versa. However, when the C57BL donor cells override the resistance of CF#1 host, some mice survived more than 60 days after the treatment, and permanent chimeras were established, while C57BL host mice transplanted CF#1 cells could not survive past 60 days. It may be concluded that the difference in radiosensitivity measured by LD50(30) between these two strains of mice largely depends on the regulatory system in hematopoietic cell kinetics but not on the capability of proliferation or sensitivity of hematopoietic cells. (auth)

6753 (NIRS-R-1, pp 66-74) STUDY OF HEMATOPOIETIC INDUCTIVE MICROENVIRONMENTS BY MEANS OF CELLULOSE ACETATE MEMBRANE-INSERTION METHOD. Seki, M.; Yoshida, K.; Inoue, E. Oct 1973. (In Japanese).

In fundamental and clinical aspects of bone marrow transplantation in April 1970–March 1973. Final report. (National Inst. of Radiological Sciences, Chiba (Japan)).

Reticuloendothelial cells of hematopoietic tissues play an essential role on the development of hematopoietic cells. On light of this, a new method of in vivo hematopoietic colony formation has been developed in this laboratory. When a piece of cellulose acetate membrane (CA membrane) is surgically inserted into the peritoneal cavity of a C3H/He mouse, a macrophage layer is formed on the membrane. After whole-body irradiation, membrane-bearing mice were injected intraperitoneally with aliquots of isologous or homologous bone marrow cells. Myeloid colonies derived from donor bone marrow cells are formed in the macrophage layer within several days of inoculation. The majority of the colonies were granuloid in nature; however, erythroid colonies were observed distinctly in some cases. Colony forming units on the CA membrane 2 days after bone marrow inoculation were shown. By the modification of this method, the effect of irradiation of host animals on the development of myeloid colonies was investigated. In unirradiated hosts, the decrease in the number of colonies was remarkable with the time after the transplantation. In irradiated hosts, the number of colonies was virtually unchanged. An increase of erythroid colonies was clearly demonstrated in irradiated hosts, which may reflect a rise of erythropoietin level after irradiation. When the host was irradiated with LD_{50} or less doses, the number of colonies was roughly proportional to the given dose, reaching to a plateau at the higher radiation dose. The results obtained suggested the increase of hematopoiesis-regulating factors in the irradiated hosts. Addition of the thymus cells into bone marrow inoculum resulted in the augmentation of myeloid colonies. Growth of thymus-derived cells on CA membrane may relate to this augmentative effect. (auth)

6754 (NIRS-R-2, pp 15-18) EFFECTS OF X-RAY AND FAST NEUTRON-IRRADIATION ON ACTIVITIES OF SPECIFIC ENZYME SYSTEMS IN NORMAL LIVER CELLS IN VIVO. Nakazawa, T.; Inada, T.; Asami, K.; Yukawa, O. Nov 1973. (In Japanese).

In first report on the cancer therapy with high energy particles and the utilization of short lived radionuclides in diagnostics. (National Inst. of Radiological Sciences, Chiba (Japan)).

The effects of x-ray and fast neutron-irradiation on activities of mitochondria and detoxication enzymes in the microsome membrane were examined to elucidate the effects of fast neutrons on normal liver cells. Experimental animals were male Wistar rats. X rays (200 keV, 20 mA) were used at a dose rate of 250R per minute, and fast neutrons were used at a dose rate of 19.5 rads. Adenine nucleotide was used as an indicator. Respiration and energy metabolism of mitochondria were examined. Although the adenine nucleotide contents decreased with general x-ray irradiation and local irradiation of the liver, the decrease of energy metabolism was not evident. The RBE of fast neutrons was about 3, but the effects of neutron irradiation on activities of energy metabolism were different from those of x-ray irradiation. Moreover, the activities of detoxication enzymes in the liver microsomes after 750-R x-irradiation and 300 rads fast-neutron irradiation were examined. Hexobarbital hydroxylation was the most strongly injured with both x-irradiation and fast-neutron irradiation. Injuries of aniline aminopyrine were almost the same with both x-ray and fast-neutron irradiation. Cytochrome P-450 contents decreased by 25% with 750R x-ray irradiation, and decreased by 35% with fast neutron irradiation. These facts indicated that the injury of detoxication enzyme was caused by the decreases of cytochrome P-450 and the reduction of connectivity of the substances. (JA)

6755 (NIRS-R-2, pp 18-25) MORTALITY RESPONSE OF GOLDFISH AFTER EXPOSURE TO FAST NEUTRONS AND RBE OF FAST NEUTRONS FOR INHIBITION OF HATCHABILITY IN ORYZIAS EMBROYS. Eto, H.; Taguchi, Y. Nov 1973. (In Japanese).

In first report on the cancer therapy with high energy particles and the utilization of short lived radionuclides in diagnostics. (National Inst. of Radiological Sciences, Chiba (Japan)).

The effects of neutrons on individuals and tissues were examined using goldfish and killifish. The survival rate, survival time, and histological changes of such organs as the kidney, intestine, and gill of neutron-irradiated fish were compared with those with x-irradiation. The relationship curve between dose in neutron irradiation and survival rate and the distribution pattern of death time in goldfish irradiated with neutrons were similar to those in x-irradiation. This indicated that the causes of death of individuals due to neutron irradiation in each dose were the same as those with x-irradiation. LD 50/30 obtained from the relationship between dose and the survival rate 30 days after the irradiation was 375 rads in neutron irradiation and 1283 rads in x-irradiation. When LD 50 was used as an indicator, the RBE was 3.4 RBE of intestinal disturbances was 3.8. In examination of the effects of 400 rads irradiation in the organs, a decrease of hematopoietic cells and a decrease of cells of the intestinal epithelium were observed. At 1,000 rads irradiation, the disappearance of hematopoietic cells and the decrease of cells of the gill were observed. Moreover, the effects of neutron irradiation on hatching rate were examined using killifish. Doses of 50% hatchability increased with the advancement of developmental stages of embryo when irradiated. The RBE value was large in the early stage of embryo and decreased to about one third just before the hatching. In each developmental stages of embryo, delay of hatching time was larger with x-irradiation than with neutron irradiation. In addition, the delay of hatching time increased with increasing dose in each stage. In an examination of the effects of oxygen on embryo during the cleavage period, 50% hatching rate was obtained by 355 rads neutron irradiation in nitrogen, and by 2,760 rads x-irradiation. Oxygen effect rate was 1.6 with neutrons and 2.2 with x rays. The RBE was 7.8 when the eggs were irradiated in nitrogen. (JA)

6756 (NIRS-R-2, pp 40-44) EFFECT OF FAST NEUTRONS IRRADIATION ON B16 MOUSE MELANOMA IN VIVO. Furuse, T.; Kubo, E.; Inada, T.; Kasuga, T. Nov 1973. (In Japanese).

In first report on the cancer therapy with high energy particles and the utilization of short lived radionuclides in diagnostics. (National Inst. of Radiological Sciences, Chiba (Japan)).

Subcutaneous inoculation of B16 implantation melanoma was done in the posterior legs of C 57 BL 16 J mice. Irradiation was carried out one time with x rays and fast neutrons. Oxygen effects on radiosensitivity were studied in vivo. X rays used in this experiment were 200 KV, 20 mA with 0.5 Cu + 0.5 Al. On irradiation, the volume of tumor increased from 1 to 3 days after irradiation, and then, began to decrease. In addition, it continued to decrease with more doses, and the minimum was lower. The speed of reproliferation was slightly delayed with more doses. B 16 melanoma did not disappear on irradiation with 4700 rads of x rays. However, RBE of fast neutrons showed 6.8 in D_{10}^{f} (90% deactivated dose), and therefore, it was found that fast neutron-rays was a useful treatment for melanoma. The proximal site of the posterior leg in mice was ligatured, and B 16 melanoma was irradiated once by x rays and fast neutrons under hypoxic conditions. In 90% deactivated dose (D_{10}^{f}), it was 2820 rads that corresponded to four times in the nonligature (705 rads). For fast neutrons D_{10}^{f} was 125 rads in non-ligature, and 200 rads in ligature. In addition, OER was 1.6. (JA)

6757 (NIRS-R-2, pp 47-49) RELATIVE BIOLOGICAL EFFECTIVENESS OF 200 KVP X-RAYS AND 2 MeV FAST NEUTRONS FOR INDUCING TRANSLOCATIONS IN SPERMATOGONIA OF MICE. Muramatsu, S.; Nakamura, W.; Eto, H. Nov 1973. (In Japanese).

In first report on the cancer therapy with high energy particles and the utilization of short lived radionuclides in diagnostics. (National Inst. of Radiological Sciences, Chiba (Japan)).

The effect of inducing translocations in chromosome of spermatogonia of mice was compared between 2-MeV fast neutrons and 200-kVp x rays. Under 24 to 94 rads of fast neutron irradiation, the frequency of translocations increased according to the irradiation dose. Regression coefficient was 11.36×10^{-4} in the straight line region, while it tended to decrease when the dose increased over 94 to 267 rads. Under 48 to 672 rads of x-ray, a straight increase with gradient of 2.69×10^{-4} of regression coefficient was found. The effects of both radiations on the induction of translocations in chromosome were compared in the dose region that showed straight increase. Relative biological effectiveness of 2-MeV fast neutron was calculated as 4.22. (JA)

6758 (NIRS-R-2, pp 57-65) EXPERIMENTAL STUDIES WITH C_3H/He MAMMARY CARCINOMA FOR FAST NEUTRON THERAPY. Tsunemoto, H.; Kutsutani, Y.; Ando, K.; Furukawa, S.; Aizawa, H. Nov 1973. (In Japanese).

In first report on the cancer therapy with high energy particles and the utilization of short lived radionuclides in diagnostics. (National Inst. of Radiological Sciences, Chiba (Japan)).

Basic investigations were performed on fast neutron therapy for C_3H/He implanted mammary carcinoma. Relative biological effectiveness of one irradiation estimated from the dose response curve in C_3H/He implanted mammary carcinoma was between 2.5 and 3.1 in air and greater in hypoxic condition. In the experiment with two doses of fractionated irradiation, the effect corresponding reoxygenation was evidently found 48 hours after the irradiation with 1,500 and 2,000 rads. Under irradiation with fast neutrons, the delay time was the longest 2 days after the irradiation with 250 rads, 5 days after 350 rads and 7 days after 500 rads. Therefore, it is predicted that the fractionated irradiation by fast neutrons acts on mitotic delay or inhibition of its initiation as well as reoxygenation. The irradiation with 100 or

170 rads of fast neutrons at intervals of 48 hours 3 times a week for 2 weeks was more effective than a single irradiation with 600 rads and 1,000 rads, respectively. Conversely, in the experiment with 500 rads of x rays as a single dose under same schedule, the fractionated irradiation was less effective than a single irradiation. The difference between the effect on hypoxic cells by multiple doses of fractionated irradiation with fast neutrons and by that of x-rays was also clearly observed. Multiple doses of fractionated irradiation with fast neutrons were more effective in therapeutic gain factor than those with x-rays and the ratio of therapeutic effectiveness is expected to be clinically improved. (JA)

6759 (NIRS-R-2, pp 66-69) RELATIVE BIOLOGICAL EFFECTIVENESS OF FAST NEUTRONS OBSERVED IN SKIN REACTIONS OF MICE AFTER SINGLE OR FRACTIONATED IRRADIATION. Aizawa, H.; Tsunemoto, H. Nov 1973. (In Japanese).

In first report on the cancer therapy with high energy particles and the utilization of short lived radionuclides in diagnostics. (National Inst. of Radiological Sciences, Chiba (Japan)).

Early and late reactions of murine normal skin after single or equally fractionated irradiation using fast neutrons or x rays are discussed. Single irradiation doses of x rays were 1000, 1500, 2000, 3000, 4000, and 5000, respectively. Total doses of x rays of 2000 or 3000 or 4000 or 5000 rads were used at intervals of one, two, three, and five days with equal split dose. Single irradiation doses of fast neutron were 300, 500, 700 and 1000 rads, respectively. Total fast neutron doses of 500, or 700 or 1000 rads were used at intervals of one, two, three, and five days with equal split dose. The result of single irradiation in early skin reaction showed that RBE of fast neutron to x-ray was 1.9, 2.4 and 2.4, and recovery dose of 24 hours after fractionated x-ray irradiation was 500-600 rads and that of 48 hours after, 980 rads. Recovery dose of fast neutron of 24 hours after fractionated irradiation was 75 rads and that of 48 after, 125 rads. They were low. In the single irradiation in late skin reaction, RBE of fast neutron to x-ray was 3.7, 3.8, and 4.2, respectively. Fractionated irradiation showed almost equal recovery dose to early reaction. When fraction period was prolonged further, skin response was fairly reduced in case of passing 300 rads of x-ray irradiation. This tendency was recognized to some degree in the group of fractionated irradiation of 1000 rads. (JA)

6760 RADIATION EFFECTS ON TESTES. II. Incorporation of ^{65}Zn After Partial Body Gamma Irradiation of Rats. Gupta, G. S.; Bawa, S. R. (Punjab Univ., Chandigarh, India). J. Reprod. Fert.; 42: No. 1, 29-34(Jan 1975).

The decrease in the uptake of ^{65}Zn by irradiated testes (720 R) was followed by recovery after 30 days. After a dose of 2000 R, uptake of ^{65}Zn was systematically reduced over a period of 74 days. Studies following the administration of testosterone and FSH to the irradiated rats confirm that the incorporation of zinc in the non germinal cells of the testes is under the control of pituitary gonadotropins. (auth)

6761 IN VIVO TESTING OF HYPOXIC RADIOSENSITIZERS USING THE KHT MURINE TUMOUR ASSAYED BY THE LUNG-COLONY TECHNIQUE. Rauth, A. M.; Kaufman, K. (Ontario Cancer Inst., Toronto). Brit. J. Radiol.; 48: No. 567, 209-220 (Mar 1975).

The KHT transplantable tumor of C3H mice has been used as a model tumor for the in vivo study of hypoxic cell sensitizers. Eleven sensitizers comprising four nitrofuran, five nitrobenzene, and two nitroimidazole derivatives, which have been shown to be effective on hypoxic mammalian cells in vitro, have been investigated. Two of these compounds, metronidazole (2-methyl-5-nitroimidazole-1 ethanol) and tinidazole (ethyl[2-(2'-methyl-5'-nitro-1'-imidazolyl)ethyl]sulfone), showed signs of hypoxic cell-sensitization in vivo when given systematically by intraperitoneal injections. In addition, preliminary testing of the nitrobenzene NDPP (p-nitro-3-dimethyl-propriophenone hydrochloride) indicated that when it was injected directly into the tumor and irradiation was completed within ten minutes after injection, appreciable sensitization was obtained. More detailed studies indicated that both metronidazole at 1,500 mg/kg and tinidazole at 750 mg/kg given intraperitoneally gave an enhancement ratio of 1.5 for a chronically hypoxic cell population in this solid tumor in air-breathing mice. Measures of plasma levels of metronidazole and enhancement ratios obtained in the present in vivo system seemed in relative agreement with the in vitro and in vivo results of others. (auth)

6762 EFFECTS OF IRRADIATION ON LIPID PEROXIDATION IN RAT ORGANS. I. Effects of Whole Body Irradiation on Lipid Peroxide Formation in Rat Organs. Watanabe, S. (Okayama Univ. (Japan). School of Medicine). Okayama Igakkai Zasshi; 85: No. 3-4, 129-136(Apr 1974). (In Japanese).

After the whole-body x irradiation (650 R) of rats, the lipid peroxide formation of various organs was estimated by the thiobarbituric acid (TBA) reaction. In TBA reaction tests on the lipid peroxidation in the liver, heart, spleen, and kidney with homogenates being incubated, the TBA value was slightly high with endogenous homogenates, but on the addition of Fe^{2+}, the reaction was further accelerated markedly. With liver and kidney that showed a high reaction on addition of Fe^{2+}, the reaction was similarly accelerated on addition of ascorbic acid, but with heart and spleen the reaction at initial stage did not show any significant difference from that of the group without any addition. In every organ from the irradiated animal the activity of lipid peroxide formation was greater than that in organs from non-irradiated control animals. TBA value in the group added with Fe^{2+} were higher than those in the group without any addition, suggesting that x irradiation greatly increased the lipid peroxidation in organs. Change in the acceleration of lipid peroxidation accompanying the irradiation appears as a shortening of reaction-induction time. Radioactivity-dose dependent change can be observed only in the liver, and the time-lapse change after irradiation can also be observed only in the liver. These results suggest that the lipid peroxidation following the whole-body x irradiation shows a significant change primarily in the liver. (auth)

6763 EFFECTS OF IRRADIATION ON LIPID PEROXIDATION IN RAT ORGANS. II. Changes in Lipid Peroxidation and Ratio of Fatty Acid Composition in Rat Organs After Irradiation. Watanabe, S. (Okayama Univ. (Japan). School of Medicine). Okayama Igakkai Zasshi; 85: No. 3-4, 137-143(Apr 1973). (In Japanese).

With four groups of rats, normal, irradiated, fasting, and irradiated-fasting rats (dose of x ray, 650 R), 48 hours afterwards, liver, heart, spleen, and kidney were examined separately as to changes in the acceleration of lipid peroxidation and fatty acids due to irradiation were examined. The lipid peroxidation in each organ was accelerated after irradiation when compared to that in the organs of normal group. In the fasting group the acceleration of lipid peroxidation was observed, but the acceleration in the irradiated group was far more marked, indicating clearly the effect of irradiation. As to changes in the ratio of fatty acid composition in every organ of the irradiated group there were observed an increase in the ratio of high unsaturated fatty acids and a decrease in the ratio of saturated fatty acids as compared with the respective values in normal group. Among organs there could be recognized no uniform change in the fasting group and the irradiated-then-fasting group. These results indicate that fasting affects the ratio of fatty acid composition, especially marked was change in triglyceride fraction. The lipid content in the liver tends to increase after irradiation, and there is also observed an increase in the ratio of lipids to phospholipids. The arachidonic acid of phospholipid that is considered to be substrate of lipid peroxidation is increased in the irradiated group, suggesting its relation to the acceleration of lipid peroxidation accompanying irradiation, and actually, the arachidonic acid ratio of phospholipid is markedly decreased after the incubation of lipid peroxidation reaction in the presence of Fe^{2+}, indicating that this substance can play the role of substrate. (auth)

6764 EFFECTS OF IRRADIATION ON LIPID PEROXIDATION IN RAT ORGANS. III. Effects of Irradiation on Lipid Peroxide Formation and Administration of Radiation-Protective Agents (in Vivo) in Rat Organs. Watanabe, S. (Okayama Univ. (Japan). School of Medicine). Okayama Igakkai Zasshi; 85: No. 3-4, 145-150(Apr 1973). (In Japanese).

Effects of tathione and cepharanthin, the radiation-protective agents, on the lipid peroxidation in rat organs were studied. The acceleration of lipid peroxide formation induced by x irradiation can be inhibited by the administration of tathione prior to the irradiation and by the dose administered. Such an inhibitory effect is especially marked in the liver, in view of correlations among x irradiation effect, lipid peroxidation, and fatty acid composition in the liver, it seems that glutathione in vivo is somehow involved in the acceleration of lipid peroxidation. The increase of lipid content observable in the liver of x-irradiated animal could not be observed in the animals administered with tathione. Cepharanthin showed no relation to the lipid peroxidation. (auth)

6765 DEATH DUE TO CONTINUOUS X-RAY IRRADIATION IN SPLENECTOMIZED MICE. Ikeda, Y.; Ikeda, K.; Nakama, M.; Kaziyama, K.; Asao, C. (Hiroshima Hospital of Japanese National Railways). Kotsu Igaku; 28: No. 1, 51-56(Jan 1974). (In Japanese).

Since the spleen of a mouse is a main extramedullary hematopoietic organ, it is, as a matter of course, very susceptible to radiation. Therefore, it is reasonable that the spleen of mouse may play an important role in the elongation of the survival period after x-ray irradiation or in the improvement of peripheral blood

pictures. The influences of splenectomy on mice death after performing continuous x-ray irradiation of 100 and 800 R that may induce hematopoietic disturbances and digestive tract disorders respectively were examined. After these experiments, it was concluded that a significant difference between splenectomized mice and control (unsplenectomized) mice could not be recognized, and furthermore, that examination should be made of lower radiation dose. (auth)

6766 INFLUENCE OF OVARIOTOMY ON RECOVERY OF THYMUS FOLLOWING X-RAY IRRADIATION IN ICR/JCL MICE. Takizawa, S.; Naito, Y.; Inoue, S. (Hiroshima Univ. (Japan). Research Inst. for Nuclear Medicine and Biology). J. Radiat. Res.; 15: No. 4, 197-203(Dec 1974).

Ovariotomy in 8 week-old, specific-pathogen-free ICR/JCL mice was effective in securing a marked thymus regeneration following a single whole-body irradiation with 300 rads of x ray. Recovery of the bone marrow cell counts, especially of the lymphoid cells, preceded the thymus regeneration and was more marked in spayed mice than in the sham-operated. On the basis of these results, it is suggested that ovarian hormones play a role in the thymic lymphopoiesis by affecting the dynamics of the lymphoid stem cells in the bone marrow and/or the lymphopoietic microenvironments in the thymic cortex. (auth)

6767 EFFECT OF X IRRADIATION ON THE PERMEABILITY OF L-ALPHA HYDROXY ACID OXIDASE FROM MOUSE LIVER PEROXISOMES. Brown, P. C.; Kleinbergs-Krisans, S. (San Diego State Coll., Calif. (USA). Dept. of Biology). J. Radiat. Res.; 15: No. 4, 204-211(Dec 1974).

Mice were exposed to 800 R whole-body x irradiation at a rate of 15 R per minute. Following exposure there was an increase in the permeability of L-alpha hydroxy acid oxidase from mouse liver peroxisomes, and an increased sensitivity of the peroxisomes to low concentration of Triton X-100. These results indicate that latency characteristics of peroxisomes from irradiated animals are altered compared to the latency characteristics of peroxisomes from control animals. (auth)

6768 EFFECT OF 6-METHYLTHIOURACIL (6-MTU) ON THE IRRADIATED THYROID GLAND. Amiragov, D. G. Biol. Zh. Arm.; 27: No. 11, 92-95(Nov 1974). (In Russian).

A study of the morphological picture of an irradiated thyroid gland after the use of 6-MTU showed that this preparation noticeably increases the functional activity of the gland. This activity was manifested in an increase of gland weight, height of the cells of the thyroid epithelium, and a decrease in the size of the inner diameters of the follicles. (SJR)

6769 EARLY RADIATION INJURY IN THE RAT PAROTID GLAND: REACTION OF ACINAR CELLS AND VASCULAR ENDOTHELIUM. Sholley, M. M.; Sodicoff, M.; Pratt, N. E. (Temple Univ., Philadelphia). Lab. Invest.; 31: No. 4, 340-354(Oct 1974).

Rat parotid glands were examined by light and electron microscopy following either 1600 or 6400 R of head and neck x irradiation. Acinar cells were the most sensitive glandular components, displaying morphologic evidence of radiation damage as early as 2 hours. Acinar cell damage appeared either as focal cytoplasmic degeneration, resembling large cytolysosomes, or as necrosis of acinar cells, manifest in the formation of unusual structures termed light bodies. This damage became maximal by 2 days, 6400 R producing much more extensive injury than 1600 R. A period of cleanup and acinar atrophy ensued by 3 days, and no further degeneration was seen after 4 days. By 4 days after the higher exposure, the glands had suffered a 47 percent weight loss, and loss of acini and decrease in acinar size was made apparent by the finding of extensive basal lamina redundancies attached to shrunken acini or lying free in the interstitium. By 8 days after either exposure, surviving acinar cells appeared relatively normal, although most contained basal lipid vacuoles and less than their normal complement of secretory granules. Ducts displayed no significant alterations. In order to determine whether primary microvascular damage could be the cause of the acinar cell damage, the microvasculature was examined for changes in permeability and ultrastructure. No increased vascular permeability to colloidal carbon or trypan blue, or both, was observed after either exposure at times as long as 8 days. In glands adequately fixed by perfusion, no histologic or ultrastructural changes were found after 1600 R, and 6400 R caused only occasional, minor swelling of endothelial cells. Such endothelial swelling was not severe enough to produce flow defects in the affected vessels. Study of capillary density changes after 6400 R revealed no actual increase or decrease in the number of capillaries. The lack of microvascular injury after 1600 R and the absence of significant alterations after even 6400 R indicate that microvascular impairment does not contribute to early acinar cell injury in the rat parotid gland. (auth)

6770 EARLY AND LATE RADIATION CHANGES FOLLOWING A SECOND COURSE OF IRRADIATION. Brown, J. M.; Probert, J. C. (Stanford Univ. School of Medicine, CA). Radiology; 115: No. 5, 711-716(Jun 1975).

The effect of two 10-fraction courses of irradiation separated by intervals varying from 1 to 10 months on both the early skin reaction and late deformity of the leg was studied in mice. It was found that the "memory" of the first course was much greater for the late end point (deformity) than for early skin reactions at all intervals between the two courses. The extent of the late deformity reaction following a second course was predicted fairly well from the Ellis formula for decay of partial tolerance, but it also appeared to be more complex than is evident from the formula. Evaluation of early vs. late reactions showed that the extent of the deformity is not governed entirely by the level of the early skin reaction; rather, it depends critically on the previous radiation history of the tissue. (auth)

6771 REPAIR OF ULTRAVIOLET IRRADIATION DAMAGE TO A CYTOPLASMIC COMPONENT REQUIRED FOR NEURAL INDUCTION IN THE AMPHIBIAN EGG. Chung, H. M.; Malacinski, G. M. (Indiana Univ., Bloomington). Proc. Natl. Acad. Sci. U.S.A.; 72: No. 4, 1235-1239(Apr 1975).

Localized ultraviolet irradiation of the amphibian egg destroys a cytoplasmic component that is required for neural induction. Destruction of that component severely diminishes the inducing capacity of the dorsal lip at gastrulation, as determined by embryological assays. Repair of the ultraviolet lesion can be achieved by replacing the dorsal lip of the irradiated embryo with a lip from an unirradiated embryo. (auth)

6772 DEVELOPMENTAL CHANGES IN THE RESPONSIVITY OF THE BRAIN TO ENDOGENOUS AND EXOGENOUS FACTORS. Timiras, P. S. (Univ. of California, Berkeley). pp 417-427 of Drugs and the Developing Brain. Vernadakis, A.; Weiner, N. (eds.). New York; Plenum Publishing Corp. (1974).

Studies on the effects of various factors on the development of the brain are reviewed. Some factors discussed are x radiation, hypoxia, antibiotics, nutrition, thyroid hormones, pentobarbital, phenothiazine, and diphenylhydantoin. (HLW)

6773 CHANGES OF MYOCARDIUM VESSELS AFTER IRRADIATION OF THE HEART REGION. Yakovleva, L. A. Med. Radiol.; 20: No. 5, 32-37(May 1975). (In Russian).

Coronary vessels of the rabbit were studied in the course of 10 days, 3, and 6 months after a single irradiation of the heart region in a dose of 2400 rad. With the help of a microangiographic method it was established that the number of vessels with the diameter up to 0.06 mm increased. The number of vessels with the diameter from 0.06 to 0.1 mm decreased. Small vessels were in dystonia condition, major vessels were narrowed, an even abrupt change of the vessel diameter was observed. (auth)

6774 ALLOGENEIC RADIATION CHIMERAS: LONG-TERM STUDIES. Tyan, M. L. (Univ. of North Carolina, Chapel Hill). Transplantation; 19: No. 4, 326-334(Apr 1975).

Lethally irradiated mice protected with allogeneic fetal liver cells or with syngeneic or allogeneic marrow and spleen cells treated with antisera to mouse immunoglobulins or to the T cell-associated theta antigen and their controls were observed for up to 750 days. The best survival rates were found in the large groups given syngeneic marrow and spleen or allogeneic fetal liver cells (70-85 percent 700-day survival); in contrast, 43 percent of the group injected with allogeneic cells treated with anti-theta serum and 19 percent of those given antiimmunoglobulin-treated cells were alive 700 days postradiation. Pulmonary infection was the most frequent cause of death of long-term survivors in all groups. Tumor incidence was increased in recipients of allogeneic cells (13 percent versus 4 percent among syngeneic chimeras), but the renal pathology seen in these groups was no greater than that noted in the syngeneic controls. Beginning 600 days after irradiation, mice from experimental and control groups were killed and their spleens were cultured with thymus-dependent antigens and the mitogens concanavalin A and lipopolysaccharide, Escherichia coli. The most frequent finding in all groups was mild to moderate impairment of T cell-dependent responses. (auth)

6775 INTERACTION MECHANISMS OF X-RAYS WITH RETINA PHOTORECEPTORS. Doly, M.; Veyre, A.; Isabelle, D. B.; Meyniel, G.; Gaillard, G. (Institut National de la Sante et de la Recherche Medicale (INSERM), 63-Clermont-Ferrand (France); Clermont-Ferrand Univ., 63 (France)). Ann. Phys. Biol. Med.; 8: No. 2, 65-77(1974). (In French).

After indicating the present interest of studying the interaction mechanism of ionizing radiations with retina photoreceptors, the results obtained by irradiation of man with different kinds of radiations are mentioned. An original method allowing the study

of such phosphenes using the isolated albino rat retina in survival is described. With this technique it is possible to record electroretinogram in response to x-ray flashes. The first results, retina survey curve, secondary effects of radiation, etc., are in accordance with a direct interaction of the incident. The x rays with the photopigment of the retina, the state of actual experimentation and the orientation for the future of this research are described. (FR)

6776 THERAPEUTIC EFFICIENCY OF MOUSE HEMOPOIETIC STEM CELLS; MODIFICATION BY ADMIXION OF THYMIC CELLS. Debons, M. C.; Duplan, J. F. (Institut National de la Sante et de la Recherche Medicale (INSERM), Fondation Bergonie, 33- Bordeaux (France)). C. R. Soc. Biol.; 168: No. 4, 489–495(1974). (In French).

The surviving fraction of bone marrow cells irradiated in vivo with 200R has an increased therapeutic efficiency while a similar treatment has no effect on spleen cells. This change is probably related to the selection of a redioresistant cell population preferentially oriented toward a granulocytic differentiation. Such a population exists in the bone marrow but not in the spleen. Admixing thymic cells to normal spleen cells decrease their therapeutic efficiency but has no effect on bone marrow cells or on previously irradiated spleen cells. This result might be considered as the consequence of a differentiation specifically oriented toward the lymphoid series at the expense of the other hemopoietic cell lines. The large number (bone marrow) or conversely the absence (spleen) of cellular elements that differentiate along the lymphoid line after simulation by thymic cells are responsible for the fact that the therapeutic efficiency of bone marrow of irradiated spleen cells is not modified by the injection of thymic cells. (FR)

6777 OLIGODIPSIA AS A CRITERION FOR THE PREDICTION OF MORTALITY OF AN IRRADIATED MOUSE. Nakamura, W.; Kobayashi, S.; Nishimoto, Y.; Takemoto, K. (National Inst. of Radiological Sciences, Chiba (Japan)). C. R. Soc. Biol.; 168: No. 4, 642–647(1974). (In French).

After an irradiation of the total body with a semi-lethal dosis of x rays, mice show an important oligodipsy occuring at least three times in the following month. A definite relationship between the importance of the second oligodipsy and life time was shown, allowing prediction of the duration of life of the animals. (FR)

6778 EFFECTS OF X-RAYS AND OF ABSTINENCE FROM FOOD OR WATER ON THE URINARY EXCRETION OF 5-HYDROXYINDOLEACETIC ACID. Nakamura, W.; Nishimoto, Y. (National Inst. of Radiological Sciences, Chiba (Japan)). C. R. Soc. Biol.; 168: No. 4, 637–641(1974). (In French).

In normal mice, starvation in the chief factor of depression of excretion of 5-hydroxyindoleacetic (5HIAA) is chiefly due to deprivation of food, not of water. Under various experimental conditions, a diminution of 50% of normal 5HIAA was observed and it is suggested that the metabolic activity of the serotonine, precursor of 5HIAA, must be maintained at a normal level for maintenance of life. The formation of serotonine from tryptophane is necessarily implicated in this process. (FR)

6779 CHANGE IN LIPOPROTEIN LIPASE ACTIVITY IN PLASMA OF TOTAL BODY IRRADIATED RABBITS. Carton, M.; Dousset, N.; Douste–Blazy, L. C. R. Soc. Biol.; 168: No. 6, 905–909(1974). (In French).

Lipoprotein lipase activity in rabbit post-heparin plasma was studied in irradiated animals. Lipoprotein lipase activity of irradiated rabbits 12 hours and 16 hours after exposure was avoided. This disappearance of lipoprotein lipase activity is probably a factor in the genesis of postirradiation hypertriglyceridemia. (FR)

6780 EFFECT OF FRACTIONATED IRRADIATION WITH FAST ELECTRONS ON THE MULTIPLICATION AND SYNTHESIS OF DNA IN CELLS OF ASCITES LYMPHOMA OF MICE. Moskalik, K. G.; Kozlov, A. P.; Akimov, A. A. (Scientific-Research Inst. of Oncology, Leningrad). Dokl. Akad. Nauk SSSR; 220: No. 5, 1195-1198(11 Feb 1975). (In Russian).

The purpose of this study was to determine the intensity of cell multiplication and the ability of tumor cells to synthesize DNA after various modes of fractionated irradiation. The experiments were carried out on ascites lymphoma NK/Ly, which was maintained by an interperitoneal grafting of ~5×10^6 cells in male mice of the SHR line. Irradiations with 20 MeV electrons were conducted as follows to give a total dose of 1000 rads: (1) daily irradiation with a single dose of 200 rads (5 irradiations in 5 days); (2) a single dose of 333 rads three times a week (3 irradiations in 5 days); (3) a single dose of 500 rads two times a week (two irradiations in 5 days). The mitotic activity and fraction of cells synthesizing DNA were carried out at 0.5, 1, 3, 6, 12, 18, 24, 36, 47, 72, 96, and 120 hr. after the first irradiation with all modes of fractionated irradiation. All modes of fractionated irradiation of ascites lymphoma suppressed the multiplication of tumor cells. Mitotic activity falls to a low level 1 to 6 hours after irradiation, and then starts to increase until it almost reaches the level of the controls at 120 hrs after irradiation. The larger the single dose, the greater was the depression in mitotic activity observed at 1 to 6 hr, and at 120 hrs after irradiation. The decrease in number of cells synthesizing DNA lagged the suppression in mitotic activity. Thus a decrease in the number of fractionated doses with a simultaneous increase in the single dose led to a greater slowdown in mitotic activity and DNA synthesis in the tumor cells. (SJR)

6781 EFFECT OF β-RAY RADIATION OF ^{90}Y ON VASCULAR WALLS AND PERIPHERAL NERVES (EXPERIMENTAL STUDY). Vichert, T. M.; Ljass, F. M. Radiobiol. Radiother.; 16: No. 1, 57-63(1975). (In German).

The pathomorphological examination of changes in the walls of the large vessels and of the peripheral nerve-cords under their immediate irradiation with β-particles of ^{90}Y is of high importance because there is always the risk of radiation overexposures to the structures of the cavernous sinus in radiosurgical intervention. A comparison of the pathological changes in the tissues of peripheral nerves and vascular walls in experimental animals (rabbits) revealed that intensity and spreading of the necrotic changes are directly dependent on the height of radiation dose. An irradiation of more than 10,000 rad only causes necroses and destructive changes in the peripheral nerve tissue. Similar changes in vascular walls of veins and arteries develop with tumor doses of 100,000 rad only. (auth)

6782 EVIDENCE OF ONCOGENIC COFACTORS IN RADIATION-INDUCED TUMORS IN MICE. Patricio, M. B.; Clode, W. H.; Ricardo, J. A. J. Surg. Oncol.; 7: No. 1, 57-61(1975).

Five groups of 587 inbred female mice (WHC) were studied to determine the incidence of tumors as affected by irradiation of different areas. A dose of 400 rad of ^{60}Co was given to all the groups. One group of 166 mice was total-body irradiated, another group of 90 mice was irradiated in the upper-third portion of the body, another group of 93 mice was irradiated in the lower two-thirds of the body, and another group of 90 mice was half-body irradiated on the right side. As control, a group of 148 nonirradiated mice was followed. The results showed a different incidence of cancer in mice, depending not only on the irradiated areas but also on the shielded ones. This suggested that other factors besides irradiation affect carcinogenesis. (auth)

6783 DIFFERENT RESPONSES OF TWO MOUSE STRAINS TO 650 RADS AND PROTECTION BY SURGICAL STRESS. Pachciarz, J. A.; Teague, P. O. (Univ. of Florida, Gainesville). Proc. Soc. Exp. Biol. Med.; 148: No. 4, 1095-1100(Apr 1975).

Radiation survival of C57Bl/6J mice after 650 rads improved from 1.7 percent to 66 percent when mice were stressed surgically one week before irradiation. Surgical stress one or three weeks before irradiation increased endogenous CFUs and decreased exogenous CFUs in C57Bl/6J and DBA/1J mice. Survival may be related to the proportion of stem cells in different phases of the cell cycle, which was abnormal in C57Bl/6J mice and compensated for by a greater number of nucleated cells per femur. (auth)

6784 MUTAGENIC EFFECT OF DIFFERENT TYPES OF IRRADIATION ON GERM CELLS OF MALE MICE. VIII. The Frequency of Reciprocal Translocations in Spermatogonia After Chronic Gamma Irradiation. Pomerantseva, M. D.; Vilkina, G. A.; Ivanov, V. N. (Inst. of General Genetics, Moscow). Genetika; 11: No. 3, 81–86(Mar 1975). (In Russian).

The frequency of reciprocal translocations in mice spermatogonia after the exposure to chronic gamma irradiation at doses of 100, 200, 300, 600, and 920 R, at the dose rate of 4.2 R/day was investigated. The mutation frequency increased insignificantly with the increase of the radiation dose ($y = 0.8 + 0.0011x$). Comparison of the data obtained with earlier results revealed no changes in the yield of translocations at the reduction of the dose rate from 10 R/day to 4.2 R/day. Investigation of the genetic radiosensitivity of mice spermatogonia after a chronic gamma irradiation showed a tendency to increase in their radioresistance. (auth)

6785 EFFECT OF IMMUNE RNA ON VARIOUS TYPES OF CELLS INTERACTING IN THE IMMUNE RESPONSE. Galaktionov, V. G.; Morgunov, O. I.; Smirnova, N. N.; Anfalova, T. V. (Inst. of Medical Genetics, Moscow). Byull. Eksp. Biol. Med.; 79: No. 4, 80–82(Apr 1975). (In Russian).

Simultaneous injection of marrow cells previously incubated with immune RNA, thymus cells, and sheep red cells to x-ray treated mice resulted in a greater accumulation of antibody-forming cells in the spleen, as compared to mice inoculated with intact cells or with those incubated with normal RNA. Preliminary incubation of thymus cells with immune RNA did not affect the accumulation of antibody-forming cells. Incubation of peritoneal exudate cells with immune or normal RNA failed to influence

the mode of accumulation of the antibody-forming cells either. (auth)

Invertebrates

6786 (NIRS-R-2, pp 25-28) THE RELATIVE BIOLOGICAL EFFECTIVENESS ON ARTEMIA EXPOSED TO FAST NEUTRONS. Iwasaki, T.; Maruyama, T.; Nichimura, A. Nov 1973. (In Japanese).

In first report on the cancer therapy with high energy particles and the utilization of short lived radionuclides in diagnostics. (National Inst. of Radiological Sciences, Chiba (Japan)).

In order to demonstrate the effects of fast neutrons on the living body, relative biological effectiveness (RBE) of fast neutron on the gonads of Artemia in each growing stage was compared with that of γ rays. In this experiment, the delay of hatching, 50% hatching time, percentage of hatching and morphological observation were tried. 2-MeV fast neutrons were used. The exposure dose on the samples was calculated by activating sulfide sections. Irradiation dose rates were 150 rads/min in dried eggs, and 100 rads/min in young and adult eggs. Telecobalt was used as the γ source. Irradiation was carried out at 2000 rads/min. As a result, RBE obtained by a hatching rate was 1.4. When the growing stages, in which dried eggs were hatched after irradiation and were bred to adult, were compared, the effect of 50 krads of γ rays corresponded to that of 5 krads of fast neutrons. The state of growing became extremely poor following 100 krads of γ rays and 10 krads of fast neutrons. Therefore, RBE was regarded as about 10. RBE in the survival rate after 3 days was 4.8. In addition, it increased to 10 with time. The effect of fast neutrons with time was larger than that of γ rays. Dried eggs were irradiated and tissues in the individual ovary survived to the living body were observed. It was found that in γ rays more than two times the doses were needed in order to produce the same disturbance as fast neutrons in spite of individual differences. (JA)

6787 (NRC/CNR-TT-1756) INFLUENCE OF SEX CHROMOSOMES ON THE RADIOSENSITIVITY OF DIFFERENT CELL TYPES OF DROSOPHILA MELANOGASTER. Leuthold, U. Translated by V. N. Nekrassoff from Mutat. Res.; 14: No. 1, 65-81(1972). 24p. Dep. NTIS (US Sales Only) $4.25.

In Drosophila melanogaster, individuals with surplus chromosomes can be produced by the crossing of adequate genotypes. The influence of such additional chromosomes on the induction of dominant lethals has been examined with x rays. Since stocks with compound sex chromosomes are available and easy to handle we used the variation of the number of sex chromosomes as a model system. Gametes and zygotes were irradiated with different radiation doses. Mature sperm were irradiated in X/Y males having respectively X and Y sperm with the same amount of chromosomes, and XY/O males with sperm of different amounts of chromosomes (XY and nullo-Y sperm, respectively). Mature eggs (stage-14 oocytes) were irradiated in X/X females whose deposited eggs form after meiosis only one type of maternal pronuclei (X pronucleus), and in XX/O females whose eggs contain maternal pronuclei of different amounts of chromosomes (XX and nullo-X pronuclei, respectively). The following couples of zygote types were examined in separate experiments: X/X and X/Y, XX/O and XY/O, as well as XY/XY and XY/O. The genotype of the respective irradiated cells could be determined by the phenotype of the surviving imagines. There exists a positive correlation between the number of irradiated chromosomes and the radiosensitivity regarding the induction of dominant lethals. The highest sensitivity per haploid chromosome set is evident in stage-14 oocytes; it is about five times less in mature sperm and zygotes. The dominant lethals were recorded separately according to early, late and postembryonic lethality. The relative frequency of these three types changes after the irradiation of eggs, sperm and zygotes. The results show that the mortality after irradiation is due to x-ray induced chromosome damage, i.e., that it depends on real dominant lethals. (auth)

6788 EFFECTS OF IONIZING RADIATION ON A GYPSY MOTH POPULATION. Tikhomirov, F. A. (Moscow State Univ.). Sov. J. Ecol. (Engl. Transl.); 4: No. 5, 380-385(1973).

Translated from Ekologiya; 4: No. 5, 15-21(1973).

The effects of irradiation on a gypsy moth population and its parasites in plantings with a high radionuclide content were studied. Irradiation in doses of 40 to 200 rad causes an increase in larval hatch; doses of more than 10^3 rad reduce the hatch. The larval and pupal survival rates for the gypsy moth were higher with high contamination levels than in the control. (auth)

Radionuclide Effects (Internal Source)

Man

Refer also to abstracts 6044, 6672, 6673, 6698, 6699, 6824, 8415, and 8420.

6789 (CONF-750413-P2, pp IV.77-IV.92) MATHEMATICAL ASPECTS OF THE YEAR 2000 RADIOLOGICAL STUDY. Dotson, W. L.; Fletcher, J. F. (Hanford Engineering Development Lab., Richland, WA), 1975.

From ANS computational methods in nuclear energy; Charleston, South Carolina, USA (15 Apr 1975).

In proceedings of the conference on computational methods in nuclear engineering. Vol. II. (Du Pont de Nemours (E.I.) and Co., Aiken, S. C. (USA). Savannah River Lab.; Energy Research and Development Administration, Aiken, S. C. (USA). Savannah River Operations Office).

The Year 2000 Radiological Study, a series of regional evaluations of radiological dose from nuclear facility operation, is based on a series of complex, interlinked computer codes designated as the HERMES model. These codes are used to model the release, environmental transport, biological uptake, and resulting radiological dose to regional populations which result from operation of large numbers of nuclear facilities within a region. Characteristics of these computer codes, and their application to specific regional studies, are described. (auth)

6790 (CONF-750518-1) AVERAGE DOSE TO AN ORGAN PER MICROCURIE-DAY ACCUMULATED BY A RADIONUCLIDE IN A SOURCE ORGAN. Snyder, W. S.; Ford, M. R. (Oak Ridge National Lab., Tenn. (USA)). 1975. 4p. Dep. NTIS $4.00.

From third European IRPA congress; Amsterdam, Netherlands (13 May 1975).

Methods are discussed that are used in calculations of the average radiation dose to an organ per microcurie/day accumulated by a radionuclide in a source organ. The dosimetric data on photons are obtained by Monte Carlo type computer calculations on a non-homogeneous phantom having the general form of the human body. (CH)

6791 (LIB/Trans-562) DETERMINATION OF URANIUM IN THE RED BLOOD CELLS OF WORKERS IN THE CHEMICAL PROCESSING OF URANIUM ORE. Nosek, J.; Simkova, M.; Kukula, F.; Musil, K. Translated from Prac. Lek.; 25: 389-391 (1973). 11p. Dep. NTIS (U. S. Sales Only) $4.00.

Neutron activation analysis was used in determining uranium in the venous blood erythrocytes of controls and of workers exposed to occupational hazards in a uranium chemical treatment plant. While 4.1 ± 2.6 ppB of uranium was found in dry matter of the erythrocytes in controls, 6.5 ± 2.1 ppB of uranium was ascertained in dry matter of the erythrocytes in occupationally exposed workers of a wet preparation plant, and 37.2 ± 20.2 ppB of uranium in the erythrocytes in workers of a dry processing plant. (auth)

6792 (LIB/Trans-563) CONFIRMATION OF INCREASED LEVEL OF URANIUM IN RED BLOOD CELLS OF MINERS FROM DEEP URANIUM MINES. Nosek, J.; Simkova, M.; Kukula, F.; Pehr, F.; Kubat, M. Translated from Prac. Lek.; 26: 124-127 (1974). 17p. Dep. NTIS (U. S. Sales Only) $4.00.

Neutron activation analysis was used for the determination of uranium content in the dry matter of the venous blood erythrocytes in uranium miners. While in the controls the content of uranium amounted to $(4.0 \pm 2.5) \times 10^{-9}$, in the uranium miners the uranium content in the erythrocytes was significantly increased. The increase was found to be directly proportional to the duration of work in the mines. (auth)

6793 SOME PROBLEMS IN THE RADIOPHARMACEUTICALS MANUFACTURE AND THE PATIENTS. Some Opinions On Allowable Concentration. Izawa, M.; Kashida, Y. (National Inst. of Radiological Sciences, Chiba (Japan)). Genshiryoku Kogyo; 20: No. 8, 20-22(Aug 1974). (In Japanese).

With respect to radiopharmaceuticals, short half-life nuclides and increase of exposure in medical workers are considered. Maximum allowable doses of nuclides such as ^{15}O, ^{11}C, and ^{13}N are described. Patient exposure and decreasing it, third person exposure, family exposure accompanying patient treatment in an out-patient clinic, and attendant exposure during hospitalization of patients were also mentioned. Elevation of knowledge and judgement capacity of doctors and the necessity of education when radiopharmaceuticals are being used generally are described. (JA)

6794 THE METHOD OF TREATMENT OF RADIOPHARMACEUTICALS. Urakubo, G. (National Inst. of Hygienic Sciences, Tokyo (Japan)). Genshiryoku Kogyo; 20: No. 8, 23-26(Aug 1974). (In Japanese).

Some instructions in treatment of radiopharmaceuticals are described from a viewpoint of protection from radiation injuries. Instructions in protection of external and internal exposure are mentioned. Control of patients who received radiopharmaceuticals is also described. Disposal of machinery and tools used in the treatment of radiopharmaceuticals, radioactive waste such as washing water and waste water is explained. Storage from the

aspect of maintenance of quality, the term of validity, and a determination method using a curiemeter are also described. (JA)

6795 USE OF TISSUE-TO-AIR RATIO IN COMPUTATION OF SPECIFIC ABSORBED FRACTION. Tripathi, U. B.; Iyer, P. S. (Bhabha Atomic Research Centre, Bombay). J. Nucl. Med.; 16: No. 6, 492-494 (Jun 1975).

A new approach is described for computing specific absorbed fractions that can be used for estimating doses that result from the internal administration of radiopharmaceuticals. This approach uses the concept of the tissue-to-air ratio (TAR) which can either be calculated or experimentally determined for the radionuclides of interest. Good agreement exists between the specific absorbed fraction values obtained using measured and computed values of TAR. This implies that the measured values of TAR can be used to obtain specific absorbed fractions for all radionuclides. (auth)

Animals

Refer also to abstracts 6747, 6842–6846, 6850, 6852, 6856, and 6869.

6796 (BNWL-SA-5339) BIOLOGICAL EFFECTS OF TRANSURANIUM ELEMENTS IN EXPERIMENTAL ANIMALS. Bair, W. J. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 15 Apr 1975. Contract AT(45-1)-1830. 96p. (CONF-750436-1). Dep. NTIS $8.00.

From seminar at the Institut fur strahlenbiologie; Karlsruhe, F.R. Germany (15 Apr 1975).

Results are reported from life span studies of the biological effects of the transuranium elements (^{238}Pu, ^{239}Pu, ^{241}Am, and ^{242}Cm) on laboratory animals following inhalation, skin absorption, or injection in various chemical forms. The dose levels at which major biological effects have been observed in experimental animals are discussed relative to the maximum permissible lung burden of 0.016 muCi for occupational exposures. Lung cancer has been observed at dose levels equivalent to about 100 times the maximum permissible lung burden. Current experiments directed towards determining whether health effects will occur at lower levels and the mechanisms by which alpha emitters induce cancer are reviewed. (CH)

6797 (ERDA-tr-1, pp 135-138) INFLUENCE OF STRONTIUM-90 AND CESIUM-137 ON THE CONTENT OF HISTAMINE AND ACETYLCHOLINE IN THE BLOOD AND TISSUES OF RATS. Fedorova, A. V. (Scientific Research Inst. of Radiation Hygiene, Leningrad). May 1975. Translated from Radiobiologiya; 14: No. 5, 754-757 (1974).

In radiobiology.

The influence of ^{90}Sr and ^{137}Cs, isotopes with different organotropism, on the content of acetylcholine and histamine in the blood and tissues of rats was studied. Definite patterns were detected in the variation of the content of acetylcholine and histamine in the blood and tissues of animals subjected to the chronic action of ^{90}Sr and ^{137}Cs. It was noted that changes in the indicated indices in the blood and tissues occurred more rapidly after the administration of ^{137}Cs. (ERB)

6798 (ERDA-tr-1, pp 183-187) EXTRAPULMONARY TUMORS IN RATS AFTER INTRATRACHEAL ADMINISTRATION OF AMERICIUM-241. Filippova, L. G.; Nifatov, A. P. May 1975. Translated from Radiobiologiya; 14: No. 5, 793-796 (1974).

In radiobiology.

The frequency of appearance of extrapulmonary neoplasms in rats after intratracheal adminstration of ^{241}Am nitrate was studied. A single intratracheal introduction of americium nitrate caused a reduction of the average lifetime only in the animals treated with americium at a dose of 2.22 μCi. An analysis of the results of the histological investigation showed that together with pneumosclerosis and tumors of the lungs, neoplasms of extrapulmonary localization are of definite significance in thanatogenesis. In rats treated with americium nitrate at doses of 0.0004 to 0.23 μCi, the total number of tumors does not differ from the control. Only in the animals that received 0.44 μCi was the number of tumors higher than in the control. The lower frequency of tumors in rats that received 2.22 μCi is evidently associated with the shortening of the lifetime of the animals in this series. The largest percentage of tumors (47.8%) was detected in the spine; in the bones of the forelimbs and hind limbs 30.4%; in the skull 21.8%; a multiple localization in the femur and spine was detected in one rat. The difference in the localization of osteosarcomas is evidently associated with the different concentration of americium in the skeleton. It should be mentioned that in the case of intraperitoneal or intravenous administration of ^{241}Am, a larger frequency of appearance of tumors was detected. (ERB)

6799 (LF-49, pp 74-79) GASTROINTESTINAL AND RESPIRATORY TRACT INJURY FOLLOWING INHALATION OF RADIOACTIVE AEROSOLS. Cuddihy, R. G. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973–1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

Tissue irradiation from inhaled radionuclides can produce multiple insult involving lung, upper respiratory tract, gastrointestinal tract and other internal organs for soluble chemical forms. Considerably greater doses are required from swallowed beta- and gamma-emitting isotopes to produce damage similar to that from external irradiation. This difference is related to uncertainties with dosimetry models for gastrointestinal tract, shielding of sensitive cells, and differing radiation distribution patterns. With inhaled radioactive aerosols, lung and nasal injury were projected to be much more significant than gastrointestinal damage except for isotopes with energetic beta emissions, short physical half-lives, and in association with insoluble aerosols greater than 2 mu m MMAD. Larger aerosols produce combined upper respiratory tract, lower gastrointestinal tract, and pulmonary injury which differ greatly from effects of whole-body or partial-body external irradiation. (auth)

6800 (LF-49, pp 85-88) TOXICITY OF INHALED BETA-EMITTING RADIONUCLIDES: AN EXPERIMENTAL APPROACH. Hahn, F. F.; McClellan, R. O.; Benjamin, S. A. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973-1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

An experimental approach to evaluation of the toxicity of inhaled beta-emitting radionuclides in experimental animals is described. Graded levels of these radionuclides are being studied in both relatively soluble ($^{90}SrCl_2$, $^{144}CeCl_3$, $^{91}YCl_3$, ^{137}CsCl) and relatively insoluble forms (^{90}Y, ^{91}Y, ^{144}Ce and ^{90}Sr in fused clay particles). Initial lung or whole-body activity burdens were selected to result in early deaths due to severe lesions at the highest levels, deaths at later times with moderate to marked pathologic changes and more subtle changes such as neoplasia at the lower levels. The organs affected vary depending on the solubility and chemical characteristics of the isotope. For radionuclides inhaled in relatively soluble forms, long-term effects have been seen in the liver, skeleton, and other tissues in addition to some pulmonary effects. In contrast, long-term effects seen in the dogs exposed to relatively insoluble forms have been mainly associated with the lung and contiguous tissues. In the latter experiments, emphasis is placed on an evaluation of the influence of radiation dose rate and total dose on the resulting dose-response relationship. Over the mid-range of the relationship between radiation dose and biological response, it will be possible to compare the relationships for the several radioactive aerosols with their different radiation dose patterns. These studies with young adult dogs are complemented with comparable studies in other species (mice, Syrian hamsters) and with animals of different ages (immature, aged). This basic approach, with emphasis on factors that alter the resulting radiation dose pattern, offers the maximum likelihood of meeting the continuing, and not always predictable, needs for information on the toxicity of inhaled beta-emitting radionuclides that may be encountered in nuclear industry operations. (auth)

6801 (LF-49, pp 89-92) TOXICITY OF INHALED $^{90}SrCl_2$ IN BEAGLE DOGS. VIII. Benjamin, S. A.; Muggenburg, B. A.; Boecker, B. B.; McClellan, R. O.; Pickrell, J. A. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973-1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

Studies on the metabolism, dosimetry, and effects of inhaled $^{90}SrCl_2$ in the Beagle dog are continuing in an effort to provide a basis for assessing the consequences of inhaling ^{90}Sr such as might be released in certain nuclear accidents. Seventy-two dogs have been exposed to aerosols containing ^{90}Sr resulting in initial body burdens ranging from 2.5 to 250 muCi ^{90}Sr/kg. Forty-eight of these dogs are being maintained for lifetime observation. Twenty-five unexposed dogs served as controls. The long-term retained burdens in these dogs range from 1 to 120 muCi ^{90}Sr/kg. Twenty-four dogs with a mean long-term retained burden of 38 muCi ^{90}Sr/kg have been assigned to a sacrifice study. Two of these dogs and 1 control dog were sacrificed at 5 days, 1 month, and 1 year after inhalation of ^{90}Sr. To date, 44 ^{90}Sr dogs have died or have been euthanized, 6 during the first 31 days after inhalation of ^{90}Sr with bone marrow aplasia and 38 between 585 and 3473 days after inhalation of ^{90}Sr. The latter group includes 12 dogs with hemangiosarcomas, 15 with osteosarcomas, 3 with fibrosarcomas, 3 with osteochondrosarcomas, 1 with osteochondrofibrosarcoma, 2 with leukemia, 1 with a baso-squamous carcinoma, 1 with a malignant giant cell tumor, 1 with a myxosarcoma, 1 with a transitional cell carcinoma, 1 with an epileptic seizure, 1 with pneumonia, and 1

with cerebellar hemorrhage (5 dogs had both a hemangiosarcoma and an osteosarcoma). The skeletons of the dogs dying with neoplasms received initial radiation dose rates of 4 to 55 rads/day and cumulative doses to death of 3300 to 22,000 rads. Six control dogs have died, 3 during the last year. One had renal amyloidosis, 1 had atheromatosis and arteriosclerosis, and 1 had aspiration pneumonia. Serial observations are continuing on the 22 surviving ^{90}Sr dogs and 16 controls. (auth)

6802 (LF-49, pp 93-97) TOXICITY OF INHALED $^{144}CeCl_3$ IN BEAGLE DOGS. VIII. Benjamin, S. A.; Boecker, B. B.; Lustgarten, C. S.; Jones, R. K.; McClellan, R. O.; Pickrell, J. A. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973-1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

Studies on the metabolism, dosimetry, and effects of inhaled $^{144}CeCl_3$ in the Beagle dog are continuing to provide information that will aid in assessing the biological consequences of inhaling ^{144}Ce such as might be released in certain nuclear accidents. Studies on the tissue distribution of inhaled $^{144}CeCl_3$ have shown that the ^{144}Ce deposited in lung is translocated at a moderately rapid rate to liver and skeleton and that significant radiation doses are accumulated by all three organs. Fifty-five dogs that inhaled $^{144}CeCl_3$ and 15 control dogs were placed in a longevity study and are being observed for their lifespan. The ^{144}Ce dogs had long-term retained burdens with values ranging from 20 to 2900 muCi. Thirty-one of the dogs exposed to $^{144}CeCl_3$ have died; 8 at 21 to 44 days after inhalation with signs attributed to severe bone marrow damage and associated pancytopenia; 2 at 138 and 144 days with radiation pneumonitis; 3 at 309 to 874 days with hepatic necrosis; 1 at 510 days with marrow aplasia; 1 at 375 days with pulmonary fibrosis; and 16 at 799 to 3081 days, most with neoplasms or myeloproliferative disorders. In this last group, 1 dog had an osteosarcoma, 3 had squamous cell carcinomas of the maxilla, 2 of the latter also having primary pulmonary neoplasms, 5 had hemangiosarcomas of the liver, 1 had a hemangiosarcoma of the nasal cavity, 2 had myelogenous leukemia, 1 had myelofibrosis with myeloid metaplasia, 1 had spinal cord ependymomas, and 2 did not have neoplasms. One of these had severe myelomalacia and the other diffuse hepatic lipidosis with severe degeneration. Two controls died; 1 with a thyroid carcinoma and 1 with aspiration pneumonia. Serial observations are continuing on the 24 surviving $^{144}CeCl_3$ dogs and 13 control dogs. (auth)

6803 (LF-49, pp 101-103) TOXICITY OF INJECTED $^{137}CsCl$ IN THE BEAGLE DOG. VII. Lustgarten, C. S.; Hobbs, C. H.; Boecker, B. B.; Jones, R. K.; McClellan, R. O.; Pickrell, J. A.; Redman, H. C. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973-1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

Studies on the metabolism, dosimetry, and effects of intravenously administered $^{137}CsCl$ in the Beagle dog are being conducted to aid in assessing the biologic consequences of exposure to ^{137}Cs such as might occur in the event of certain nuclear accidents. Effects of the chronic, relatively uniform whole-body exposure produced by ^{137}Cs are being compared with other diverse radiation dose patterns resulting from inhalation of radioactive aerosols. Sixty-six dogs were entered into the study; 6 with a mean initial ^{137}Cs body burden of 3780 muCi/kg, and 5 groups of 12 dogs each with mean initial ^{137}Cs body burdens of 2820, 1940, 1420, 970, and 0 muCi/kg. All six of the highest level dogs died 19 to 33 days post-injection with cumulative whole-body doses of 950 to 1400 rads. Three dogs in the 2820 muCi/kg level died at 24 to 27 days post-injection with cumulative whole-body doses of 860 to 910 rads. One dog in the 2820 muCi/kg level and one dog in the 1940 muCi/kg level died at 77 and 81 days after injection with cumulative whole-body doses of 1300 to 1400 rads. These early deaths were attributed to severe bone marrow damage which was reflected in an early dose related pancytopenia. A dog injected with 1900 muCi/^{137}Cs/kg died 693 days post-injection with necropsy findings attributed to shock. A dog injected with 2800 muCi/kg died 1594 days post-injection with aspiration pneumonia and a dog with 2900 muCi/kg was euthanized 1704 days post-injection with severe arthritis. A control dog died 647 days after initiation of the study with clinicopathological manifestations of auto-immune hemolytic anemia. Forty ^{137}Cs dogs and 11 controls are surviving at 2047 to 2301 days after being placed on experiment. The surviving ^{137}Cs dogs had initial body burdens that ranged from 880 to 3000 muCi/kg and received cumulative whole-body doses of 550 to 2200 rads. Serial observations are continuing on all survivors. (auth)

6804 (LF-49, pp 104-107) TOXICITY OF INHALED ^{90}Y IN FUSED CLAY PARTICLES IN BEAGLE DOGS. VI. Hobbs, C. H.; Chiffelle, T. L.; Hahn, F. F.; Jones, R. K.; Mauderly, J. L.; McClellan, R. O.; Pickrell, J. A. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973-1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

Studies on the metabolism, dosimetry, and effects of inhaled ^{90}Y in fused clay in the Beagle dog are being continued to assess the consequences of inhalation of an energetic beta emitter that has a short effective half-life in the lung. A radiation dose pattern study in which 12 dogs were sacrificed in pairs at 0, 2, 4, 6, 8, and 12 days post-inhalation exposure has been completed. A longevity study in which 89 dogs have been exposed to ^{90}Y fused clay with initial lung burdens ranging from 80 to 5200 muCi/kg body weight and 12 control dogs were exposed to stable yttrium in fused clay is in progress. The ^{90}Y was retained in lung with a half-life similar to its physical half-life (64 hours) and with only small quantities translocated to tracheobronchial lymph nodes, skeleton, and liver. The infinite radiation doses to lung, tracheobronchial lymph nodes, skeleton, and liver for an initial lung burden of 100 muCi ^{90}Y/kg of body weight were estimated to be 1600, 170, 0.54, and 0.38 rads, respectively. Thirty-eight of 39 dogs with doses to lung from 9300 to 70,000 rads have died at 7.5 to 903 days post-exposure. The one surviving dog in this dose range has radiographic evidence of pulmonary fibrosis at 1316 days post-exposure. All the dogs that died had radiation pneumonitis. The dog that died at 903 days post-exposure with a dose to lung of 11,000 rads also had 2 small pulmonary adenomas. Fifty exposed dogs with doses to lung of 1300 to 7900 rads are surviving with no significant abnormalities at 1278 to 1834 days post-exposure and will be studied for the remainder of their lifespan. (auth)

6805 (LF-49, pp 113-117) TOXICITY OF INHALED ^{144}Ce FUSED CLAY PARTICLES IN BEAGLE DOGS. VII. Hahn, F. F.; Boecker, B. B.; Hobbs, C. H.; Jones, R. K.; Mauderly, J. L.; McClellan, R. O.; Pickrell, J. A. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973-1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

The metabolism, dosimetry, and effects of inhaled ^{144}Ce in fused clay particles are being investigated in the Beagle dog to aid in assessing the biological consequences of release of ^{144}Ce in a relatively insoluble form such as might occur in certain types of nuclear accidents. The toxicity of inhaled ^{144}Ce fused clay is also of general interest since it is representative of intermediate-lived beta-emitting radionuclides. Two major studies with young adult dogs (12 to 14 months of age at exposure) are involved: (1) a metabolism and dosimetry study in which 24 dogs were serially sacrificed over an extended period of time, and (2) a longevity study with 2 series of dogs; Series I with 15 dogs exposed to aerosols of ^{144}Ce in fused clay particles to yield initial lung burdens of 11 to 210 muCi/kg body weight and 3 control dogs exposed to nonradioactive fused clay particles and Series II with 96 dogs exposed to aerosols of ^{144}Ce in fused clay particles to yield initial lung burdens of 0.0024 to 66 muCi/kg body weight and 12 control dogs exposed to nonradioactive fused clay particles. Twenty-eight dogs died or were euthanized at 143 to 2396 days after inhalation of ^{144}Ce. The prominent findings were radiation pneumonitis in 17 dogs that died or were euthanized at early time periods and neoplastic disease in 10 of the 11 dogs that died or were euthanized at 750 days or later; 5 with hemangiosarcoma of the lung, 1 with both a hemangiosarcoma and a fibrosarcoma of the lung, 1 with both a bronchiolo-alveolar carcinoma and a hemangiosarcoma of lung, 1 with a hemangiosarcoma of lung, bronchiolo-alveolar carcinoma, and a bronchiogenic adenocarcinoma, and 1 each with a hemangiosarcoma of the mediastinum and of the spleen. The cumulative radiation dose to the lung at time of death has ranged from 22,000 to 140,000 rads. Serial observations are continuing on the 83 survivors and 15 controls. (auth)

6806 (LF-49, pp 126-129) TOXICITY OF INHALED ^{90}Sr FUSED CLAY PARTICLES IN BEAGLE DOGS. V. Snipes, M. B.; Boecker, B. B.; Hahn, F. F.; Hobbs, C. H.; Mauderly, J. L.; McClellan, R. O.; Pickrell, J. A. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973-1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

Studies on the metabolism, dosimetry, and biological effects of ^{90}Sr in fused clay particles in Beagle dogs have continued with a view toward defining the biological consequences of inhaling this important radionuclide in a relatively insoluble form. Seventy-two dogs were exposed to a polydisperse aerosol (AMAD 1.4 to 2.8 mu m and sigma/sub g/1.4 to 2.7) of fused montmorillonite clay particles labeled with ^{90}Sr to achieve graded initial lung burdens (ILB) of 3.7 to 94 muCi/kg body weight; 12 control dogs were exposed to an aerosol of stable strontium in fused clay particles. These 84 dogs were assigned to the ^{90}Sr fused clay longevity study. An additional 26 dogs were exposed similarly (AMAD 1.9 to 2.5 mu m and sigma/sub g/ 1.6 to 2.0) and assigned for sacrifice

(Series II) at intervals after exposure to define metabolism and dosimetry of this aerosol in Beagle dogs. Of the 72 longevity dogs, 32 dogs having ILBs of 29 to 94 muCi/kg and cumulative doses to lung to death of 40,000 to 96,000 rads have died from radiation pneumonitis and/or pulmonary fibrosis from 159 to 477 days post-exposure. Fourteen dogs with ILBs of 15 to 36 muCi/kg and cumulative doses to lung to death of 34,000 to 68,000 rads have died from primary pulmonary hemangiosarcomas between 644 and 1214 days post-exposure. In addition, one dog developed a bronchiolo-alveolar carcinoma, another epidermoid carcinoma of the lung and a third, a squamous cell carcinoma in the nasal cavity. The remaining 26 exposed dogs and 12 controls of the longevity study are surviving at 1070 to 1707 days post-exposure. Dogs in the sacrifice series have been sacrificed to 1536 days post-exposure. (auth)

6807 (LF-49, pp 130-135) TOXICITY OF INHALED $^{144}CeO_2$ IN IMMATURE, YOUNG ADULT, AND AGED SYRIAN HAMSTERS. II. Hobbs, C. H.; McClellan, R. O.; Benjamin, S. A. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973-1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

Syrian hamsters have been exposed to aerosols of $^{144}CeO_2$ at 28 (immature), 84 (young adult), and 340 (aged) days of age to better define the dose-response relationships following inhalation of this radionuclide by a population with a wide range of ages such as would be the case with a human population following a catastrophic nuclear accident. The animals were exposed to achieve graded initial lung burdens (ILB) for the younger exposure ages of about 20, 5, 1.25, 0.31, 0.80, and 0.01 muCi and control groups exposed to stable cerium oxide. The aged animals were exposed to achieve ILB of 20, 5, 1.25, and 0.31 muCi as well as a control group. Animals are being maintained both for serial sacrifice to determine the radiation dose pattern and for lifespan observation to determine dose-response relationships. The effective half-life of ^{144}Ce in the lung appears to be about 63 days. This would result in a dose to lung of about 4000 rads/muCi of ILB. Animals with ILB of about 20 muCi have died at early times with radiation pneumonitis and pulmonary fibrosis. No excessive mortality compared to that of controls has been observed in the remaining exposure levels. Histopathologic examination is not complete on all animals that have died, but no pulmonary neoplasms have been observed to date. (auth)

6808 (LF-49, pp 136-139) TOXICITY OF INHALED ALPHA-EMITTING RADIONUCLIDES: AN EXPERIMENTAL APPROACH. Hobbs, C. H.; McClellan, R. O.; Lustgarten, C. S.; Mewhinney, J. A.; Miglio, J. J.; Raabe, O. G.; Slauson, D. O. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973-1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

A series of interrelated dose-response studies in which Beagle dogs and Syrian hamsters are being exposed to aerosols of transuranic alpha-emitting radionuclides is described. The characteristics of monodisperse aerosols of ^{239}Pu, ^{238}Pu, ^{241}Am, ^{244}Cm, and ^{242}Cm oxides are discussed relative to their use in studies to determine the relative importance of such factors as the local dose around the particle, the specific activity of the particle and the size and number of particles inhaled (the hot particle question) on the resulting biological effects. Other factors such as the elemental characteristics and the chemical form of the material and the age of the animal at the time of inhalation which may influence the toxicity of these radionuclides are also being studied. The purpose of the studies is to determine the basic relationships between the radiation dose pattern and the resulting biological effects. (auth)

6809 (LF-49, pp 140-144) TOXICITY OF INHALED $^{238}PuO_2$ IN BEAGLE DOGS: A. Monodisperse 1.5 mu m $^{238}PuO_2$ Particles, B. Monodisperse 3.0 mu m $^{238}PuO_2$ Particles I. Lustgarten, C. S.; Mewhinney, J. A.; Hobbs, C. H.; Jones, R. K.; Mauderly, J. L.; McClellan, R. O.; Miglio, J. J.; Pickrell, J. A.; Raabe, O. G. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973-1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

Studies on the metabolism, dosimetry, and biological effects of inhaled $^{238}PuO_2$ particles have been initiated in Beagle dogs. To obtain essential information on the importance of the homogeneity or non-homogeneity of the radiation dose to lung (the hot particle question), dogs have been exposed to monodisperse aerosols (sigma/sub g/ less than 1.2) of $^{238}PuO_2$ of either 1.5 mu m or 3.0 mu m aerodynamic diameter. By using monodisperse particles of these two sizes, the average dose to lung is held constant for a given initial lung burden (ILB) but the local alpha dose around the two sizes of particles varies by a factor of about 10. To date, 48 dogs have been exposed to each of the two particle sizes of $^{238}PuO_2$ (total of 96 dogs) resulting in graded ILBs which range from 0.008 to 2.2 muCi/kg of body weight. Sixteen dogs exposed to a diluent aerosol are serving as controls. Of the total activity inhaled, the dogs exposed to 1.5 mu m AD particles deposited 53 percent in total body and 43 percent in the pulmonary region while corresponding deposition values in the dogs exposed to 3.0 mu m AD aerosols were 73 percent and 45 percent. All the dogs are surviving with no detectable abnormalities at from 10 to 293 days post-inhalation exposure. It is anticipated that an additional 48 dogs (24 for each particle size) and 8 controls will be added to these dose-response studies over the next few months. In addition, a serial sacrifice study will be initiated to determine the radiation dose pattern resulting from inhalation of these monodisperse sizes of $^{238}PuO_2$. (auth)

6810 (LF-49, pp 186-188) EFFECT OF ^{144}Ce--^{144}Pr AND PARTIAL-HEPATECTOMY ON THE PRODUCTION OF LIVER TUMORS IN THE CHINESE HAMSTER. Brooks, A. L.; Benjamin, S. A.; McClellan, R. O.; Jones, R. K. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973-1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

Six hundred and fifty (650) Chinese hamsters have been introduced into an experiment to determine the combined effect of partial-hepatectomy and intraperitoneal injection of ^{144}Ce-^{144}Pr citrate on the production of liver tumors. Injected activity levels ranged from 0.036 to 0.25 mu Ci ^{144}Ce/gm body weight and they had either no further treatment or were partially-hepatectomized at either 20 days before or 20 or 200 days after injection. Controls were subjected to a similar surgical schedule. To date, 50 animals have been sacrificed at 600 days and 334 animals at 700 days post-injection. The dose to the liver at sacrifice has ranged from 1,300 to 10,000 rads and produced from 0.50 to 3.20 chromosome aberrations/cell. Of 230 animals injected with ^{144}Ce and allowed to live 700 days after injection, 46 developed liver tumors, mainly hepatocellular neoplasms, although 2 fibrosarcomas, 2 hemangiosarcomas, and 1 bile duct adenoma were seen. There have been no hepatic neoplasms in the 102 control animals. There were no clear relationships established between liver tumors and radiation dose or chromosome aberration frequency. Partial hepatectomy following injection with ^{144}Ce-^{144}Pr caused a significant increase in liver tumor incidence. Internally deposited ^{144}Ce-^{144}Pr is thus an effective inducer of hepatic neoplasia and partial-hepatectomy, acting as a promoting agent through stimulation of cell division, further increases tumor frequency. (auth)

6811 (LF-49, pp 189-191) EFFECT ON CANINE LYMPHOCYTE FUNCTION OF ^{144}Ce INHALED IN FUSED CLAY PARTICLES. Benjamin, S. A.; Ferris, A. C. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973-1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

Beagle dogs exposed by inhalation to ^{144}Ce in fused clay particles develop a persistent lymphopenia and the remaining peripheral lymphocytes in these dogs show a depressed in vitro response to plant mitogens. These studies were designed to evaluate the cellular basis for this defect. The survival and growth of lymphocytes from irradiated and control dogs were evaluated through 96 hours of culture. Many irradiated lymphocytes that were viable in vivo died within 24 hours in vitro. The remaining lymphocytes appeared to grow normally indicating that the early in vitro death was responsible for at least a portion of the difference between irradiated and control lymphocyte cultures. A second experiment was designed to determine if any humoral factors in plasma of irradiated dogs were responsible for the poor response of the lymphocytes. Lymphocytes from irradiated and control dogs were grown with plasma from both types of animals. Heterologous plasma had no apparent effect on lymphocyte growth, indicating that humoral factors were not involved. (auth)

6812 (LF-49, pp 192-196) COMPARATIVE EFFECTS OF INHALED RELATIVELY INSOLUBLE FORMS OF ^{90}Y, ^{144}Ce, AND ^{90}Sr ON CANINE PERIPHERAL LYMPHOCYTE FUNCTION. Benjamin, S. A.; Jones, R. K.; Snipes, M. B.; Lustgarten, C. S. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973-1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

Dogs that have inhaled relatively insoluble forms of either alpha- or beta-emitting radionuclides manifest a peripheral lymphopenia, the development and course of which is both total dose and dose-rate dependent. The remaining peripheral lymphocytes in dogs exposed to longer lived beta-emitting radionuclides show depressed response to plant mitogens in vitro. This experiment was designed to evaluate the effect of dose rate on peripheral lymphocyte function by exposing dogs to aerosols of radionuclides with varied effective half-lives in the lungs; ^{90}Y (2.6 days), ^{144}Ce (170 days), and ^{90}Sr (650 days). Three groups of four adult Beagle dogs each were exposed by inhalation to ^{90}Y, ^{144}Ce, or ^{90}Sr in

fused clay particles. Two controls were matched with each group. Hematologic parameters and lymphocyte function as measured by the ability of lymphocytes to respond to plant mitogen stimulation were evaluated on a weekly or biweekly basis through 8 weeks post-exposure and monthly thereafter. The ^{90}Y-exposed dogs showed a marked lymphopenia within one week with a return to control levels by 20 weeks post-exposure. The remaining peripheral lymphocytes, however, showed no functional changes in these dogs. Animals exposed to ^{144}Ce or ^{90}Sr in fused clay developed a progressive and persistent lymphopenia and showed functional depression of the remaining lymphocytes as well. The relationships between dose pattern, lymphopenia, and lymphocyte function depression are discussed. (auth)

6813 (LF-49, pp 197-202) EFFECT OF ^{144}Ce INHALED IN FUSED CLAY PARTICLES ON THE TRACHEOBRONCHIAL LYMPH NODES. Hahn, F. F.; Boecker, B. B.; Hobbs, C. H.; Jones, R. K.; Muggenburg, B. A. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973–1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

Tracheobronchial lymph node changes and lymphopenia are sequelae to inhalation of relatively insoluble radioactive aerosols by Beagle dogs. To assess the development of these lesions, tracheobronchial lymph nodes from dogs that inhaled ^{144}Ce in fused clay particles were examined at intervals from 2 to 730 days after exposure. Initial lung burdens in the dogs studied ranged from 33 to 63 mu Ci/kg body weight. The concentration of radioisotope in the tracheobronchial lymph nodes increased during the first year after exposure and exceeded that in the lung about 100 days after exposure. Autoradiographs of the lymph nodes showed that ^{144}Ce particles were present in macrophages in the paracortical zone two days after exposure and that concentrations continued to increase in the paracortical zone and medullary cords. Histologic changes in the nodes included atrophy of the germinal centers and lymphocytic follicles, loss of lymphocytes and accumulation of macrophages in the paracortical zone, accumulation of pigment and isotope-laden macrophages in the medullary cords, occasional infiltrates of neutrophils in the medullary cords and, at later time periods, focal fibrosis of the medullary cords. Tracheobronchial lymph node weights of the dogs exposed to ^{144}Ce in fused clay were not decreased until 512 days after exposure. These findings indicate that tracheobronchial lymph nodes accumulate relatively high burdens of ^{144}Ce after inhalation of ^{144}Ce in a relatively insoluble form and that the pathologic changes resulting from these burdens are basically atrophic in nature. Primary neoplasms in lymph nodes have not been observed in dogs with initial lung burdens from 0.0024 to over 30 mu Ci/kg body weight followed for up to 2000 days post-exposure. At the higher levels, however, a high incidence of primary pulmonary neoplasia has been observed. (auth)

6814 (LF-49, pp 203-205) DEXTRAN POTENTIATION OF THE CANINE LYMPHOCYTE RESPONSE TO PLANT MITOGENS. Benjamin, S. A.; Ferris, A. C. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973–1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

Peripheral blood lymphocytes from beagle dogs were separated using a dextran sedimentation technique. Lymphocyte cultures were stimulated by the plant mitogens phytohemagglutinin (PHA) and pokeweed mitogen (PWM), both in the presence of dextran and after dextran had been removed from the medium. Dextran acted synergistically with both PHA and PWM and greatly potentiated the mitogenic response of the lymphocytes. The routine use of dextran in separating blood lymphocytes for culture purposes should be reevaluated in light of these findings. (auth)

6815 (LF-49, pp 211-214) ANTIBODY RESPONSES AND PULMONARY LESIONS AFTER INHALATION OF $^{144}CeO_2$ OR $^{239}PuO_2$ AND SUBSEQUENT INFLUENZA VIRUS INFECTION IN MICE AND SYRIAN HAMSTERS. Lundgren, D. L.; Hahn, F. F.; Sanchez, A.; McClellan, R. O. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973–1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

Mice were exposed by inhalation to $^{144}CeO_2$ or $^{239}PuO_2$ and Syrian hamsters were exposed by inhalation to $^{144}CeO_2$. Animals were then infected with influenza virus 7 days or 3, 6, or 12 months after inhalation exposure and entered into groups for either serial sacrifice or lifespan observation. Serially sacrificed animals were bled to obtain sera for serological confirmation of influenza virus infection. There was a definite suppression of complement fixing antibody in mice infected with influenza virus 6 months after inhalation exposure to $^{239}PuO_2$. Previous observations of severe metaplasia with squamous cell differentiation in mice exposed to $^{144}CeO_2$ and subsequently infected with influenza virus was not confirmed by observations of animals examined to date. (auth)

6816 (LF-49, pp 229-232) PULMONARY COLLAGEN METABOLISM AFTER LUNG INJURY FROM INHALED ^{90}Y IN FUSED CLAY. Pickrell, J. A.; Harris, D. V.; Benjamin, S. A.; Cuddihy, R. G.; Pfleger, R. C.; Mauderly, J. L. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973–1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

Syrian hamsters were exposed by inhalation to an aerosol of ^{90}Y in fused clay particles to study pulmonary fibrosis. Cumulative radiation doses to lung ranged from 2000 to 14,000 rads and animals were sacrificed 2 to 24 weeks after exposure. One day before sacrifice, each hamster was injected with ^{14}C-proline to label pulmonary collagen. An increase in the fractional incorporation of ^{14}C-proline into native collagen as compared to controls was noted in animals sacrificed 2 weeks after exposure. This increase reached a plateau at about 13 weeks when the fractional incorporation in irradiated hamsters was 175 percent of the mean control values. Collagen degradation increased to a similar degree at early times (2 to 13 weeks) after exposure, but later returned to almost control values. Pulmonary native collagen showed progressive increases which were different from controls by 8 weeks after exposure when mild fibrosis was observed histologically. Static lung compliance values were decreased at early times (2 to 8 weeks) after exposure, but became indistinguishable from those of controls at later times. (auth)

6817 (LF-49, pp 237-239) EFFECT OF INJURY AND ANTIOXIDANTS ON PULMONARY COLLAGEN METABOLISM IN SYRIAN HAMSTERS. Pickrell, J. A.; Harris, D. V.; Benjamin, S. A.; Pfleger, R. C.; Mauderly, J. L. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973–1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

Syrian hamsters exposed to an aerosol of ^{90}Y in fused clay received cumulative doses to lung of 3000 to 11,000 rads. These animals developed pulmonary fibrosis characterized by an early increase of collagen synthesis which leads to collagen accumulation. Butylated hydroxyanisole (BHA) and butylated hydroxytoluene (BHT) were fed to these hamsters to evaluate the antioxidant properties of these drugs in preventing irreversible pulmonary connective tissue changes. At an early time (5 weeks after exposure) when collagen synthesis was increased but breakdown and accumulation were normal, BHA-BHT did not alter either the biochemical or the anatomical and physiological responses. At a later time (12 and 19 weeks after exposure) when breakdown and accumulation were elevated and scarring was present, oral BHA-BHT did not alter these radiation-induced responses. It appears that oral BHA-BHT has no measurable protective effect against radiation-induced pulmonary fibrosis in Syrian hamsters. (auth)

6818 (LF-49, pp 277-280) PREVENTION OF RADIATION PNEUMONITIS FROM INHALED ^{144}Ce IN BEAGLE DOGS BY BRONCHOPULMONARY LAVAGE. Muggenburg, B. A.; Boecker, B. B.; Hahn, F. F.; Mauderly, J. L.; McClellan, R. O. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973–1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

The efficacy of bronchopulmonary lavage and chelation therapy to remove ^{144}Ce inhaled in fused clay particles and prevent radiation pneumonitis was evaluated in dogs. Sixteen beagle dogs were divided into three groups. Eight dogs (Group I) were treated with a series of 10 bronchopulmonary lavages and 10 injections of diethylenetriaminepentaacetic acid during the first 56 days after inhalation exposure to ^{144}Ce in fused clay particles. As a result of treatment, 46 percent of the initial lung burden of ^{144}Ce was removed and six of eight dogs survived to 550 days after exposure. Four dogs (Group II) were exposed by inhalation to ^{144}Ce but were not treated. One dog survived to 550 days after exposure. Non-survivors in both groups died of radiation pneumonitis 170 to 240 days after exposure. The remaining four dogs were not exposed to ^{144}Ce but were given the lavage treatment; all survived to 550 days. (auth)

6819 (LF-49, pp 314-317) BIOLOGICAL EFFECTS OF REPEATED INHALATION EXPOSURE OF BEAGLE DOGS TO AEROSOLS OF ^{144}Ce IN FUSED CLAY PARTICLES. I. Boecker, B. B.; Lustgarten, C. S.; McClellan, R. O.; Thomas, R. G. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973–1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

This experiment was initiated to study the biological behavior and long-term effects of repeated inhalation exposures to ^{144}Ce in fused clay particles compared with those seen in Beagle dogs that received a single exposure as young adults. The 36 dogs,

divided into four equal groups, are exposed every 8 weeks to achieve the following: to maintain lung burdens of 9 and 4.5 mu Ci ^{144}Ce/kg body weight in the first and second groups, respectively; to increase the lung burden by 2.5 mu Ci ^{144}Ce/kg body weight in the third group with each exposure and to expose controls (fourth group) to fused clay containing stable cerium. With these exposure sequences, the ^{144}Ce-exposed dogs will receive increasing or maintained beta dose rates in contrast to the steadily decreasing dose rate seen after a single inhalation exposure. Exposures to the first and third groups will produce a cumulative absorbed dose to lung of approximately equal to 35,000 rads and those to the second group will yield approximately equal to 17,000 rads within 2 yr after the first exposure. Single exposure dogs that had died with pulmonary neoplasia when this experiment was initiated had cumulative doses to death of 29,000 to 61,000 rads. Six of the planned 13 exposures have been completed to date. All exposed dogs are surviving and will be maintained for lifespan observation. (auth)

6820 EFFECT OF CONTAMINATION OF SOILS WITH RADIOACTIVE ISOTOPES STRONTIUM-90 AND YTTRIUM-90 ON SOIL-DWELLING INVERTEBRATES. Turchaninova, V. A.; Tikhomirov, F. A. (Inst. of Evolutionary Morphology and Animal Ecology, Moscow). Sov. J. Ecol. (Engl. Transl.); 4: No. 5, 453-454(1973).

Translated from Ekologiya; 4: No. 5, 101-102(1973).

The investigations were carried out in June, 1970 and May, 1971 on experimental forest plots contaminated in 1964 with radioactive isotopes (solutions of ^{90}Sr and ^{90}Y (Karaban' and Tikhomirov, 1968). The soils were light gray medium loams; the underlying rock consisted of metamorphosed shales with mica inclusions. A soil profile showed the following horizons: A_0—1-2 cm, A_1—2-17 cm, B—17-42 cm, transition BC—42-58 cm, C_1—58-115 cm, and C_2—115-140 cm. (auth)

6821 VIRUS-LIKE PARTICLES IN ^{224}Ra-INDUCED MURINE OSTEOSARCOMAS. Marquart, K. H. (Gesellschaft fuer Strahlen- und Umweltforschung, Munich). Beitr. Pathol.; 152: No. 2, 116-126(Jul 1974).

Electron microscopic investigation of osteosarcomas from three mice, induced by the incorporation of ^{224}Ra, and an osteosarcoma metastasis from the liver of one of the animals revealed the presence of peculiar intracellular particles in all of the tumors. The particles were spherical, measured about 80 nm in diameter and consisted of two electron-dense, ring-shaped, membrane-like shells which concentrically surrounded an electron-lucent core. Nearly all of the particles with this doughnut-like ultrastructural appearance occurred in cisternae of the rough-surfaced endoplasmic reticulum (RER) of tumor cells. They were seldom observed in intracytoplasmic smooth-surfaced vacuoles or located freely in the cytoplasmic matrix. Crescent-shaped particles were occasionally found presumably in the stage of formation by budding into cisternae of the RER from its membrane component. The ultrastructure, size, and formation of the particles, as well as their location in relation to intracellular structures, are similar to those described for type A viral particles. The significance of the virus-like particles, especially in relation to the pathogenesis of the malignant bone tumors, is not known at present. (auth)

Nuclide Kinetics and Toxicology

Refer also to abstract 5910.

Man

Refer also to abstracts 6044, 6051, 6424, 6447, 6670, and 6907.

6822 (BNWL-SA-5037(Rev.)) DETECTION OF PLUTONIUM WITH AN INTRAESOPHAGEAL PROBE. Swinth, K. L.; Park, J. F.; Voelz, G. L.; Ewins, J. H. (Battelle Pacific Northwest Labs., Richland, Wash. (USA); Los Alamos Scientific Lab., N. Mex. (USA); California Univ., Livermore (USA). Lawrence Livermore Lab.). Jan 1975. Contract AT(45-1)-1830. 20p. (CONF-750707-1). Dep. NTIS $5.25.

From annual meeting of the Health Physics Society; Buffalo, New York, USA (13 Jul 1975).

A principal route of internal contamination for workers exposed to plutonium is via the respiratory tract from which deposited material will be translocated to other portions of the body including the thoracic lymph nodes. Over an extended period of time (several years) the highest concentrations of plutonium will be found in these lymph nodes, which will account for a significant percentage of the inhaled material. The plutonium in some of the thoracic lymph nodes (tracheobronchial) can be counted by positioning a detector within the esophagus near the tracheal bifurcation. A fiber-optic coupled scintillator was developed to perform this measurement. The projected detection limit of this probe is 3.0 nCi, which is over ten times lower than a previously developed probe using a silicon avalanche detector. The probe was evaluated on animals and on a human volunteer. Tests on the accidentally exposed human indicated approximately 7 nCi in the tracheobronchial lymph nodes. Probe counts must be corrected for contributions from plutonium in the lungs and for isotopic composition of the plutonium. (auth)

6823 (BNWL-SA-5380) URANIUM IN MAN BASED ON URINARY EXCRETION DATA. Held, K. R.; Walsh, W. P.; Houston, J. R. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1974. 30p. (CONF-750445-2). Dep. NTIS $4.50.

From conference on occupational health experience with uranium; Arlington, Virginia, USA (28 Apr 1975).

Generalized models for making prompt and final evaluations of uranium uptakes and resulting dose commitments to lung and bone using urinary excretion data are presented. Pathways and clearance times generally recognized and accepted by most researchers are described for class D, W, and Y compounds of uranium. This includes exponential clearance from the lung to blood and clearance from bone described by a power function equation. Although this paper, by request, deals with evaluations using urinary excretion data solely, this practice is not recommended since a much better evaluation can be made by combining urinary excretion and in vivo examination data. (auth)

6824 (LF-49, pp 29-36) DOSIMETRY AND CELLULAR RISK FOR PLUTONIUM PARTICLES IN THE LUNG. Snipes, M. B.; Brooks, A. L. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973-1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

Current standards use absorbed radiation dose for uniformly dispersed radionuclide as the basis for defining risk and a maximum permissible lung burden (MPLB). Present data are insufficient to prove that a uniform dispersion of plutonium in lung tissue is more or less hazardous than a particulate form where discrete centers of alpha activity yield higher radiation doses to their surroundings than would occur for uniformly dispersed radionuclides. Tissue adjacent to and irradiated by these particles may represent only a small fraction of the total lung. The implications of a higher dose and dose rate to these small tissue volumes necessitate the determination of the relative risk to lung tissue for this pattern of radionuclide distribution. This paper discusses biological and physical factors associated with particle dosimetry in lung tissue. Data are presented, along with theoretical examples, which suggest that particulate forms of plutonium in lung tissue are less hazardous than a uniformly dispersed lung burden. A most important factor in lung dosimetry for particulate forms of plutonium is cell turnover time. Cells with short turnover times are at greatest risk from larger plutonium particles, whereas cells with long turnover times are at greatest risk from small plutonium particles. Analysis indicates that, using 200 rads as a lethal dose to individual cells, particles of $^{238}PuO_2$ from 0.1 mu m to 0.3 mu m represent the maximum size particles which deliver a sublethal dose to some portion of the dose sphere around the particle during the time period 10 to 365 days after exposure. Comparable numbers for $^{239}PuO_2$ are 0.6 mu m to 2 mu m, respectively. Particles large enough to produce a radiation dose to surrounding cells greater than 200 rads during the critical time period yield cell death with a subsequent decrease in cell risk, or potential for carcinogenesis. (auth)

6825 (SAAS-173, pp 3-13) RAPID IDENTIFICATION OF INCORPORATED RADIONUCLIDES WITH A Ge(Li) SPECTROMETER. Klucke, H. Dec 1974. (In German).

In reports of the State Ministries for atomic safety and radiation protection of the DDR.

A device for measurements of accidental internal contamination of personnel is described. The device is fitted with a Ge(Li) detector and located within the steel shielding chamber of a whole-body counter. Calibration was performed with phantoms containing solutions of ^{133}Ba, ^{22}Na, ^{134}Cs, ^{137}Cs, ^{60}Co, and ^{40}K. The application of the measuring device in a case of internal contamination with $^{95}Zr/^{95}Nb$ is reported. (auth)

6826 WHOLE BODY COUNTING OF ^{131}I ADMINISTERED PATIENTS WITH HYPERTHYROIDISM, AND ESTIMATIONS OF ABSORBED DOSES OF ^{131}I TO VARIOUS ORGANS. Saegusa, K. (Chiba Univ. (Japan). School of Medicine). Nippon Igaku Hoshasen Gakkai Zasshi; 34: No. 9, 404-415(Jun 1974). (In Japanese).

Treatment of hyperthyroidism with ^{131}I is now one of the well-established procedures. Of 173 patients treated with ^{131}I during the period from September 1968 to October 1970 in Chiba University Hospital, whole-body counting was carried out with a high level whole-body counter. From the ^{131}I retention curves of each patient the effective half-lives of ^{131}I in the whole body and the thyroid gland were determined. Using cumulated activity

obtained from these data, mean absorbed doses delivered to various organs of each patient were estimated. The calculation of the absorbed doses is based on the method proposed in MIRD pamphlet. The calculated value of the radiation dosage delivered to a target organ of each patient showed a wide variation. The results of the mean effective half-lives of ^{131}I in the whole body, which were determined from the whole-body retention curves of each patient, were 0.41 ± 0.24 days for the first phase, and 6.30 ± 0.92 days for the second phase of the two phase type, and 5.90 ± 0.97 days for the one phase type. The mean half-life of the thyroid gland was 6.0 ± 1.1 days for the two phase type, and 5.6 ± 1.2 days for the one phase type, which was a little less than that of the whole body. The estimated values of the radiation dosage received by individual organ for each mCi given to the patient are as follows: average dose to the whole body is 1.2 ± 0.3 rads, the liver 2.2 ± 1.0 rads, the blood 1.7 ± 0.6 rads, the bone marrow 1.1 ± 0.4 rads, and the gonads 1.1 ± 0.3 rads. (auth)

6827 ANOMALIES OF ERYTHROCYTE UPTAKE OF ^{86}Rb IN LEUKEMIA PATIENTS. Chollet, P.; Bard, J. J.; Bidet, J. M.; Plagne, R.; Meyniel, G. (INSERM, Clermont-Ferrand, France). Biomedicine; 21: No. 1, 30-35(20 Jan 1974). (In French).

The uptake of rubidium-86 by human red blood cells was studied in vitro on leukaemic patients with various cytologic types. The uptake rate is significantly reduced in slightly less than half of the patients. This alteration is not correlated with the cytologic type of the disease. On the other hand, rubidium uptake is higher than normal in patients with very light leucocytosis. This seems to be related to the rubidium uptake by white blood cells. The existence of a relationship between these alterations and some abnormalities in blood groups or enzymatic activities reported in leukaemias is consequently possible but needs some further comparative investigations. (auth)

6828 STUDY OF ^{131}I-INSULIN METABOLISM IN PATIENTS. Slavnov, V. N.; Epshtein, E. V. (Kiev Scientific-Research Inst. of Endocrinology Material Exchange). Med. Radiol.; 20: No. 5, 22-24(May 1975). (In Russian).

The authors elaborated a simple and easily carried out method performed under outpatient conditions of the study of ^{131}I-insulin metabolism in the body, which envisages, alongside with the investigation of the permeability of the vessels, the study of elimination of radioactive products of insulin metabolism with the urine from the body and its binding with the proteins of the blood serum. By studying the patients with endocrine pathology which was established on the basis of clinico-laboratory data, the authors discovered various changes of ^{131}I-insulin metabolism in the body. (auth)

Animals

Refer also to abstracts 6047–6050, 6441, 6442, 6445, 6799–6809, 6813, 6818, and 6819.

6829 (BNWL-SA-5367) MODEL FOR PREDICTING STRONTIUM-90 LEVELS IN MULE DEER. Schreckhise, R. G.; Whicker, F. W. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Mar 1975. Contract AT(11-1)-1156. 35p. (CONF-750503-14). Dep. NTIS $4.75.

From 4th national symposium on radioecology; Corvallis, Oregon, USA (12 May 1975).

A predictive model was developed which effectively estimated the strontium-90 levels in male mule deer (Odocoileus hemionus hemionus) from known ^{90}Sr intake rates. The model was formulated on results from a study on the effects of age and season on the kinetics of Sr in mule deer. Captive deer of various ages, at selected times throughout the year, were given acute oral doses of $^{85}SrCl_2$ and whole body counted to determine the retention function. A two-component exponential equation provided the best mathematical description of the retention of ^{85}Sr. The average for the slopes of the short component (1.09/day) corresponded very closely with the mean retention time for insoluble material in the gastrointestinal tract. For male deer the value of the fractional intercept of the long component generally increased with age. The fractional intercepts also varied with the time of year the deer was administered the ^{85}Sr, ranging from an average of 0.0539 during antler dormancy to 0.154 during periods of antler growth. The average of the observed values for the slope of the long component was 0.00365/day for all deer. For the bucks, the slope of the long component was observed to decrease with age at time of spiking and to vary from a minimum for those spiked during antler dormancy to a maximum for those spiked during the antler growth period. There were no apparent effects of age and season on the kinetics of Sr in female deer. The variations in the fractional intercept and the slope of the long component, both associated with skeletal bone remodeling, necessitated construction of a model which utilized varying parameters to describe the uptake and retention of chronically ingested Sr. The predicted values were compared with those observed in a wild deer population and the close agreement added credibility to the coefficients of the total body retention equations which were utilized in the model. (auth)

6830 (CEA-R-4630(Pt.2,3,4)) ACCUMULATION OF SOLUBLE AND INSOLUBLE FORMS OF ^{59}Fe BY MARINE MOLLUSC AND FISH (MYTILUS EDULIS AND BLENNIUS PHOLIS). II. Relations Between Contamination Processes and Growth Stages. III. Accumulation in Various Organs as a Function of the Physico-Chemical Forms of the Radionuclide. IV. Decontamination Process of Individuals After Uptake of Either Physico-Chemical Form. Fraizier, Albert. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Protection). Jan 1975. 30p. (In French). INIS.

The concentration by two marine species: Mytilus edulis and Blennius pholis, of soluble and insoluble forms of ^{59}Fe in sea water was studied experimentally. An inverse correlation was found between the contamination of individuals and their growth, which meant it must be linked to the metabolic activity of Mussels and Blennies and confirmed that exchanges between species and contaminant, whatever its physico-chemical form, were greatly related to physiological processes. Uptake was generally more important at the level of organs involved in nutrition and respiration. A comparison of the contamination power of ^{59}Fe soluble and insoluble forms, respectively, showed that the latter were always more contaminating, in proportions varying with the organs. This uptake seemed enhanced at the level of the mantle and the adduction muscle in Mussels, of the skin in Blennies, and suggested the occurrence of passive adsorption processes. In both species decontamination showed two stages at least, a faster one (2-4 days) and a secondary one, usually very slow. In Mussels, iron complexed by EDTA has a faster passage than the insoluble forms, with a biological half-life of about 15 days. (FR)

6831 (LF-49) INHALATION TOXICOLOGY RESEARCH INSTITUTE ANNUAL REPORT, 1973–1974. Boecker, B. B.; Rupprecht, F. C. (eds.). (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)). Dec 1974. 384p. Dep. NTIS $10.60.

Separate abstracts were prepared for the 76 papers presented in this annual report. (ERB)

For abstracts of individual papers see: 6047–6051, 6406, 6747, 6748, 6799–6819, 6824, 6832–6873, and 6886–6889.

6832 (LF-49, pp 15-20) ALVEOLAR MICROENVIRONMENT AND ITS RELATIONSHIP TO THE RETENTION AND TRANSPORT INTO BLOOD OF AEROSOLS DEPOSITED IN THE ALVEOLI. Kanapilly, G. M. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973–1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

Pertinent information from the literature is critically reviewed to obtain a comprehensive view of the nature of the alveolar microenvironment, with emphasis on the properties that may affect the retention kinetics of inhaled materials in the alveoli. The ultrastructure of the air-blood-barrier, its permeability characteristics and the nature of the alveolar fluid are examined. Indirect evaluation of the general solute concentrations, pH, precipitating and chelate forming agents of the alveolar fluid were made. Based on this information, possible mechanisms for the retention kinetics in the lung of inhaled, water soluble trivalent materials are discussed. (auth)

6833 (LF-49, pp 37-39) SHORT-TERM METABOLISM OF THREE SIZES OF MONODISPERSE $^{238}PuO_2$ AEROSOLS IN BEAGLE DOGS. Mewhinney, J. A.; Miglio, J. J.; Hobbs, C. H.; McClellan, R. O. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973–1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

Inhalation exposures of 30 Beagle dogs were conducted using monodisperse and polydisperse aerosols of $^{238}PuO_2$ to measure the initial pulmonary deposition and short term translocation of ^{238}Pu to other tissue. Three sizes of monodisperse aerosols (0.7, 1.5, 3.0 mu m AD) were compared with a single polydisperse size (1.5 mu m AMAD) in this study. Animals were sacrificed at 0, 8, and 32 days after inhalation exposure and tissues analyzed for ^{238}Pu content radiochemically. Initial pulmonary deposition decreased as monodisperse particle size increased and the polydisperse aerosol closely resembled the smaller monodisperse size in initial deposition. Upper respiratory clearance was nearly complete at 8 days after inhalation. Minimal translocation of ^{238}Pu to tissues was found at 8 and 32 days post-inhalation exposure. Transport of $^{238}PuO_2$ particles to tracheobronchial lymph nodes appeared to be particle size dependent at 32 days after inhalation. (auth)

6834 (LF-49, pp 40-42) LUNG RETENTION AND TISSUE DISTRIBUTION OF INHALED ^{239}Pu AEROSOLS PRODUCED AT DIFFERENT TEMPERATURES. Mewhinney, J. A.; Muggenburg, B. A.; Miglio, J. J.; McClellan, R. O. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973–1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

Lung retention and tissue distribution of inhaled ^{239}Pu aerosols produced at temperatures of 325, 600, 900, and 1150°C were studied in Beagle dogs for 56 days duration. Aerosol characterization showed no differences in activity median aerodynamic diameter, geometric standard deviation, or in estimated density among the various treatment temperatures. Lung retention and tissue distribution were determined in three animals at each aerosol production temperature and found to be influenced by production temperature. At the lower two temperatures, significant translocation of ^{239}Pu to liver and skeleton occurred whereas at the higher temperatures, only very small quantities of ^{239}Pu were found in extrapulmonary tissues. Translocation of ^{239}Pu from lung to tracheobronchial lymph nodes was not affected by aerosol production temperatures. (auth)

6835 (LF-49, pp 43-47) INHALATION EXPOSURE OF PONIES TO AEROSOLS OF ^{169}Yb-LABELED $^{238}PuO_2$. Mauderly, J. L.; Mewhinney, J. A.; Raabe, O. G.; Cuddihy, R. G.; Slauson, D. O.; Miglio, J. J. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973–1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

Techniques and apparatus were developed for the exposure, maintenance, and profile scanning of Shetland-type ponies. Two ponies were exposed to monodisperse aerosols of ^{169}Yb-labeled $^{238}PuO_2$. One pony was maintained for 36 days after exposure, but had an abnormal lung which made projections about early distribution and translocation of ^{238}Pu difficult. The ability to achieve substantial lung burdens of inhaled particulates and to perform meaningful linear profile scans in the pony was demonstrated. (auth)

6836 (LF-49, pp 48-52) SEVEN-YEAR STUDY OF THE PULMONARY RETENTION AND CLEARANCE OF ^{137}Cs INHALED IN FUSED ALUMINOSILICATE PARTICLES BY THE BEAGLE DOG. Boecker, B. B.; Cuddihy, R. G.; Hahn, F. F.; McClellan, R. O. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973–1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

Long-term pulmonary retention and clearance were studied using 30 Beagle dogs given single, 15-min inhalation exposures to ^{137}Cs-labeled fused aluminosilicate particles (AMAD equals 1.5 to 1.7 mu m, sigma/sub g/ equals 1.6 to 1.8). An average of about 60 percent of the initial body burden was excreted rapidly, primarily in the feces; the remainder was retained for much longer periods. In 2 dogs observed for 7 years after exposure, the longest component of whole-body retention had an associated biological half-life of 580 days. Tissue analyses for dogs sacrificed in pairs out to 7 years after exposure showed prolonged retention in the lung, transfer of significant quantities to the tracheobronchial lymph nodes, and some soft tissue accumulation of released ^{137}Cs. Results have been incorporated into a kinetic model to study the relative importance of various lung clearance mechanisms. These data on long-term lung retention and translocation to tracheobronchial lymph nodes are significantly different than those observed previously in dogs exposed by inhalation to $^{239}PuO_2$. (auth)

6837 (LF-49, pp 53-56) BIOLOGICAL MODEL FOR RETENTION OF INHALED ^{95}Nb IN BEAGLE DOGS. Cuddihy, R. G. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973–1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

Retention kinetics of inhaled ^{95}Nb in Nb(V)-oxalate and Nb(V)-oxide aerosols were studied in Beagle dogs. Data were analyzed in terms of a mathematical model which was constant for both aerosol forms except in representing pulmonary clearance to blood. Very soluble ^{95}Nb from oxalate particles was rapidly translocated to skeleton and liver, although less soluble fractions remained in lung for an extended time. Insoluble oxide aerosols were retained in lung with a half-time approaching the physical half-life, although very minor soluble fractions were deposited in skeleton and liver similar to ^{95}Nb absorbed from oxalate forms. For both aerosol forms, lung tissues received more significant radiation exposures than other organs due to the short physical half-life of 35 days. (auth)

6838 (LF-49, pp 57-61) BILIARY EXCRETION OF ^{144}Ce FOLLOWING INHALATION OF ^{144}Ce CITRATE BY RATS. Lustgarten, C. S.; Cuddihy, R. G.; Boecker, B. B.; Huber, N. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973–1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

Liver clearance of soluble ^{144}Ce was found in previous studies to be faster in mice, rats, and rabbits than in beagle dogs or Chinese hamsters. Measurement of biliary excretion of ^{144}Ce in these species should aid in determining reasons for these differences. In a pilot study, 28 young adult rats were exposed by inhalation to an aerosol of ^{144}Ce citrate in a CsCl vector to achieve retained body burdens of 10 to 20 mu Ci. Bile was collected for 12 hours from 4 to 6 different rats on 1, 2, 4, 8, 16, and 32 days after exposure and was measured for ^{144}Ce activity. After collection, the rats were sacrificed and their tissues were counted to determine ^{144}Ce content. It was found that hepatic content decreased by 4.1 percent per day and that biliary excretion accounted for 15 to 25 percent of the decrease. (auth)

6839 (LF-49, pp 62-64) IN VITRO ELUTION OF ^{85}Sr FROM BONES OF BEAGLE DOGS AFTER IN VIVO INCORPORATION. Kanapilly, G. M.; Wesselman, D. M. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973–1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

In vitro elutions of ^{85}Sr from femurs and ribs of Beagle dogs, after in vivo incorporation, were studied by continuously eluting the bones with a synthetic ultra filtrate of blood. Both whole bones and split bones, obtained from two dogs each at 1 day and 8 days post-injection, were eluted for 3 to 5 weeks. After elution, the fractional retention of ^{85}Sr in the bones of the same dog were comparatively lower for: (1) ribs than femurs, (2) split bones than whole bones, and (3) bones obtained 1 day post-injection than 8 days post-injection. (auth)

6840 (LF-49, pp 65-68) ABSORBED DOSE DISTRIBUTION PATTERNS IN THE BEAGLE THORAX AFTER INHALATION OF ^{90}Sr-^{90}Y FUSED CLAY PARTICLES. II. Snipes, M. B.; Runkle, G. E.; Hulbert, A. J. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973–1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

This experiment was designed to examine absorbed dose patterns in the Beagle dog thorax after inhalation of polydisperse fused montmorillonite clay particles labeled with ^{90}Sr-^{90}Y. Sixteen dogs were exposed nose-only to achieve initial lung burdens of 91 to 200 mu Ci. Dogs are being serially sacrificed and photographic data and autoradiographic data produced for a series of parallel planes approximately 1 cm apart through the thorax. Data analysis will include definition of absorbed dose patterns in the Beagle thorax at 8 days, 64 days, 1 year, 2 years, and 3 years post-exposure. To date, 8-day, 64-day, and 1-year animals have been sacrificed and partially analyzed. The result of this experiment will be a better understanding of deposition and absorbed dose patterns and allow a better correlation between absorbed dose and biological response for Beagle dogs exposed to relatively insoluble aerosols contaminated by energetic beta-emitting radionuclides. In addition, results will allow quantitating anomalies in deposition patterns, such as the striated pattern near ribs previously observed in this laboratory. (auth)

6841 (LF-49, pp 69-73) DISTRIBUTION PATTERNS OF INHALED POLYDISPERSE ^{147}Pm FUSED CLAY PARTICLES IN THE BEAGLE DOG THORAX WITH AND WITHOUT LAVAGE THERAPY. Snipes, M. B.; Runkle, G. E.; Muggenburg, B. A.; Hulbert, A. J. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973–1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

An experiment was designed to examine dispersion and retention patterns for polydisperse aerosols of fused montmorillonite clay particles labeled with ^{147}Pm. Fourteen dogs were exposed and scheduled for serial sacrifice at 0, 8, 64, and 365 days post-exposure. Experimental procedures included producing a series of slices through the thorax at approximately 1 cm intervals and obtaining a series of autoradiograms and 35 mm color transparencies for each set of thorax slices to define (1) the average doses to lung, lung lobes, and other tissues of interest, (2) the number of hot spots of activity per unit volume in the lung, and (3) a size distribution for these hot spots. Comparable data will be analyzed for 4 additional dogs subjected to lavage therapy to remove a portion of the burden from either the left or right lung using 1 or 5 treatments. Totals of 31 to 71 percent of the initial left or right lung burden were removed by the lavage therapy but only preliminary observations are completed on the autoradiography data. (auth)

6842 (LF-49, pp 98-100) TOXICITY OF INHALED $^{91}YCl_3$ IN BEAGLE DOGS. VII. Muggenburg, B. A.; Benjamin, S. A.; Boecker, B. B.; McClellan, R. O. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973-1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

Studies on the metabolism, dosimetry, and effects of inhaled $^{91}YCl_3$ in Beagle dogs are being continued to provide information that will aid in assessing the biological consequences of nuclear accidents in which ^{91}Y or other radionuclides that produce a similar radiation dose pattern may be released. Forty-two dogs with ^{91}Y initial body burdens from 64 to 1300 muCi/kg body weight were placed in four groups with mean lung burdens of 310, 180, 75, and 40 muCi/kg body weight. These dogs and 12 control dogs are being maintained for lifetime observation. An additional group of four dogs with a mean initial ^{91}Y body burden of 180 muCi/kg body weight were placed in a sacrifice study. Eleven dogs within the highest activity level groups died or were euthanized at 12 to 33 days after inhalation of ^{91}Y with changes related to severe bone marrow damage and associated pancytopenia. Two dogs died approximately one year after ^{91}Y inhalation with convulsive seizures that were presumed to be unrelated to the ^{91}Y exposure. Four ^{91}Y-exposed dogs died or were euthanized due to neoplasms 2000 to 2560 days after exposure. Two dogs had squamous cell carcinomas involving the maxillary and nasal regions, one a bronchiolo-alveolar carcinoma of the lung and another, a mast cell sarcoma. One control dog died of empyema. Serial observations are continuing on all surviving dogs. (auth)

6843 (LF-49, pp 108-112) TOXICITY OF INHALED ^{91}Y FUSED CLAY IN BEAGLE DOGS. IV. Hobbs, C. H.; Cuddihy, R. G.; Hahn, F. F.; Jones, R. K.; Kanapilly, G. M.; Mauderly, J. L.; McClellan, R. O.; Pickrell, J. A. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973-1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

Studies of the radiological hazards due to inhalation of ^{91}Y in fused clay particles are being conducted in Beagle dogs to aid in assessing the biological consequences of inhaling a relatively insoluble, energetic beta-emitter with a short-to-intermediate effective half-life in the lung. These consist of two parallel efforts involving inhalation of ^{91}Y in fused clay particles: (1) a radiation dose pattern study in which 30 dogs were serially sacrificed from 0 to 320 days post-exposure, and (2) a longevity study in which 96 dogs received initial lung burdens ranging from 11 to 360 mu Ci ^{91}Y/kg body weight and 12 control dogs were exposed to stable yttrium in fused clay. The aerosols ranged in size from 1.5 to 2.6 mu m AMAD. Total body deposition of ^{91}Y ranged between 40 and 50 percent of the inhaled activity with about 22 percent deposited in the alveolar region of the lung. The ^{91}Y deposited in the alveolar region was retained with a mean effective half-life of 50 days whereas the whole-body effective half-life was 53 days. Small quantities of ^{91}Y were translocated to the tracheobronchial lymph nodes, liver, and skeleton. Concentration in the tracheobronchial lymph nodes exceeded that of the lung by 50 days after exposure. To date, 42 dogs have died in the longevity study between 113 and 1388 days post-exposure. Forty of these dogs with cumulative radiation doses to lung from 8300 to 60,000 rads died with clinico-pathologic findings of radiation pneumonitis and/or pulmonary fibrosis at 113 to 1011 days post-exposure. Two dogs that died at 1115 and 1388 days post-exposure, respectively, with cumulative doses to lung of 23,000 and 25,000 rads had primary malignant pulmonary epithelial neoplasms. All survivors will be observed over their total lifespan with particular attention directed toward relating the radiation dose distribution with the resulting clinico-pathologic effects. (auth)

6844 (LF-49, pp 118-121) TOXICITY OF ^{144}Ce FUSED CLAY PARTICLES INHALED BY IMMATURE BEAGLE DOGS. III. Boecker, B. B.; McClellan, R. O.; Hahn, F. F.; Hobbs, C. H.; Mauderly, J. L. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973-1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

The metabolism, dosimetry, and biological effects of ^{144}Ce fused clay particles inhaled by immature Beagle dogs (approximately 3 months of age at exposure) are being investigated for comparison with studies of dogs exposed at 12 to 14 months of age and 8 to 10.5 years of age. These studies will assess possible age-related differences in the biological behavior and effects of inhaled radionuclides, differences that may be of significance in predicting the response of accidentally-exposed human populations that include individuals of different ages. Eighteen immature dogs have been entered into a radiation dose pattern study to be serially sacrificed at different intervals after inhalation exposure. During the first 2 months post-exposure, lung clearance and uptake by the tracheobronchial lymph nodes appeared to be greater in the immature dogs than in young adult dogs. Also, skeletal uptake was greater than hepatic uptake in the immature dogs. Three blocks of longevity animals, 10 per block, with graded initial lung burdens ranging from 0.004 to 120 muCi ^{144}Ce/kg body weight and 1 control, are currently on experiment. Three dogs with initial lung burdens of 73 to 120 muCi ^{144}Ce/kg body weight died at 66 to 121 days after exposure with pulmonary injury and congestive heart failure. Another dog with an initial lung burden of 70 muCi ^{144}Ce/kg body weight died at 511 days after exposure with pulmonary injury. Serial observations are continuing on the surviving 26 ^{144}Ce-exposed and 3 control dogs. (auth)

6845 (LF-49, pp 122-125) TOXICITY OF ^{144}Ce FUSED CLAY PARTICLES INHALED BY AGED DOGS. III. Hahn, F. F.; Boecker, B. B.; Hobbs, C. H.; Jones, R. K.; McClellan, R. O.; Pickrell, J. A. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973-1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

The toxicity of ^{144}Ce fused clay particles inhaled by 8- to 10.5-year-old dogs is being investigated to provide information on age-related differences in the response of older members of the human population to accidental inhalation of radioactive aerosols. These data on aged dogs will be compared to the results of similar studies using dogs exposed at approximately 3 months or 12 to 14 months of age. To date, 7 blocks of 5 dogs each, divided into 4 exposure levels with mean initial lung burdens of 7.5, 14, 24, and 57 muCi/kg body weight and control dogs exposed to non-labeled fused clay particles have been entered into a longevity study. Twelve dogs with initial lung burdens ranging from 20 to 75 muCi ^{144}Ce/kg body weight and cumulative doses to lung of from 22,000 to 74,000 rads have died at 197 to 943 days post-inhalation with clinico-pathologic findings of radiation pneumonitis and pulmonary fibrosis. Two of these also had congestive heart failure. In addition, 4 dogs with ILBs of 8 to 14 muCi ^{144}Ce/kg body weight have died of mammary neoplasms or congestive heart failure but without radiation pneumonitis. One dog with an ILB of 9 muCi ^{144}Ce/kg body weight died with a chronic interstitial foreign body pneumonia. Two control dogs have died, one with a mammary carcinoma and one with pyometra. Pulmonary retention of the inhaled ^{144}Ce was similar to that observed previously in dogs exposed at 18 to 22 months of age in a radiation dose pattern study. Serial observations are continuing on the 11 surviving ^{144}Ce-exposed dogs and 5 controls. (auth)

6846 (LF-49, pp 145-149) TOXICITY OF INHALED POLYDISPERSE OR MONODISPERSE AEROSOLS OF $^{238}PuO_2$ IN SYRIAN HAMSTERS. II. Mewhinney, J. A.; Hobbs, C. H.; McClellan, R. O.; Miglio, J. J.; Slauson, D. O. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973-1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

Syrian hamsters have been exposed via inhalation to polydisperse aerosols, or one of three sizes of monodisperse aerosols of $^{238}PuO_2$ to achieve seven levels of initial lung burden in the polydisperse study and four levels at each of the three monodisperse studies. Animals were exposed as young adults at 84 days of age. Groups of animals are being maintained for serial sacrifice to determine the radiation dose pattern and for lifespan observation to determine dose-response relationships. The data show slight translocation of ^{238}Pu from the lung to liver and skeleton to 256 days post-exposure, confirming the relatively insoluble nature of the $^{238}PuO_2$ particles. Significant excess mortality has been observed in animals exposed at the higher levels (100 to 720 nCi achieved initial lung burden) in the polydisperse study. The major pathological finding in animals that have been examined has been radiation pneumonitis and pulmonary fibrosis. No malignant lesions have been observed to date. Observations are continuing on all survivors. (auth)

6847 (LF-49, pp 150-155) TOXICITY OF INHALED $^{239}PuO_2$ IN IMMATURE, YOUNG ADULT, AND AGED SYRIAN HAMSTERS. II. Hobbs, C. H.; Mewhinney, J. A.; Slauson, D. A.; McClellan, R. O.; Miglio, J. J. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973-1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

Syrian hamsters have been exposed at either 28 (immature), 84 (young adult), or 340 (aged) days of age to polydisperse aerosols of $^{239}PuO_2$ to better define dose-response relationships for this radionuclide in a population with a wide range of ages such as would be the case with a human population following a catastrophic nuclear accident. Animals were exposed to obtain initial lung burdens of 240, 60, 15, 3.8, 0.95, 0.25, and 0.029 nCi for the immature and young adult animals and 240, 60, 15, and 3.8 nCi for the aged animals. Animals are being maintained both for serial sacrifice to determine the radiation dose pattern for lung and other tissues and for lifespan observation to determine dose-response relationships. At the present time, only animals with ILB of about 200 nCi or higher exposed as either immature, young adult, or aged animals have shown increased mortality as compared to controls. At this time, the young adult, immature, and aged animals are 68, 73, and 27 weeks post-inhalation exposure, respectively. The animals that

died in the higher ILB groups had radiation pneumonitis and pulmonary fibrosis along with atypical pulmonary epithelial hyperplasia. Histopathological examination is not complete on all animals that have died, but no pulmonary neoplasms have been observed to date. (auth)

6848 (LF-49, pp 156-159) TOXICITY OF INHALED POLYDISPERSE OR MONODISPERSE AEROSOLS OF $^{241}AmO_2$ IN SYRIAN HAMSTERS. Mewhinney, J. A.; Hobbs, C. H.; Slauson, D. O.; Boyd, H. A. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973-1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

Syrian hamsters were exposed via inhalation to polydisperse or monodisperse aerosols of $^{241}AmO_2$ to better define the resulting dose-response relationships. The data reported are preliminary because the study has been in progress less than 1 year. Animals were exposed to achieve graded initial lung burdens of 240, 60, 15, 3.8, 0.95, 0.24, and 0.029 nCi ^{241}Am for the polydisperse aerosol and 240, 60, 15, and 3.8 nCi ^{241}Am for three sizes of monodisperse aerosols (0.75, 1.5, and 3.0 mu m AD). Animals are being maintained both for serial sacrifice to determine the radiation dose pattern and for lifespan observation to determine dose-response relationships. To date only animals with the highest two initial lung burden levels have shown an excess mortality compared with the control groups. The major pathological findings to date in animals that have died has been radiation pneumonitis and pulmonary fibrosis. Observations are continuing on all surviving animals. (auth)

6849 (LF-49, pp 160-164) EFFECT OF INHALED ^{90}Y IN FUSED CLAY PARTICLES ON THE GASTROINTESTINAL TRACT OF BEAGLE DOGS. Hahn, F. F.; Barnes, J. E.; Hobbs, C. H.; Mauderly, J. L. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973-1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

Ten Beagle dogs were exposed by inhalation to aerosols of ^{90}Y in fused clay particles to study the radiation dose to the gastrointestinal (GI) tract and effects resulting from clearance of the upper respiratory tract after the deposition of high initial body burdens of inhaled ^{90}Y. Focal colonic lesions were found in 2 dogs, 8 and 12 days after inhalation of ^{90}Y which resulted in transient GI burdens (GIB) of 18 and 34 mCi. Similar, but less severe, lesions were found in 2 dogs sacrificed 27 days after exposure with GIBs of 18 and 32 mCi. No GI lesions were found in 6 dogs with GIBs of 9 to 18 mCi. Two of the 10 dogs had thermoluminescent dosimeters surgically implanted in the GI tract lumen and submucosa. Highest radiation doses were measured in the colon. One dog, with measured doses to the colon of 3200 to 5700 rads, had focal colitis when sacrificed 8 days after exposure. The other dog, with doses to colon of 1000 to 2800 rads had no GI lesions at sacrifice 8 days after exposure. Although focal colitis was found, no dogs died due primarily to GI injury. Other significant findings were nasal dermatitis and radiation pneumonitis. The latter was more severe and life threatening than the GI injury. (auth)

6850 (LF-49, pp 165-169) CHROMOSOME ABERRATION FREQUENCY IN BLOOD LYMPHOCYTES OF ANIMALS WITH ^{239}Pu LUNG BURDENS. Brooks, A. L.; LaBauve, R. J.; McClellan, R. O.; Jensen, D. A. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973-1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

Other investigators have suggested a causal relationship between accidental ^{239}Pu exposures in man and the presence of chromosome aberrations in blood lymphocytes. To assess this relationship experimentally, 16 Rhesus monkeys and 171 Chinese hamsters were exposed by inhalation to $^{239}PuO_2$ aerosols and an additional five hamsters were injected with ^{239}Pu citrate and the frequency of aberrations in blood lymphocytes determined. Lung burdens in the hamsters were estimated by serial sacrifice and radioanalysis. After an initial rapid clearance phase, the ^{239}Pu was retained in the monkey lung with a long effective half-life (greater than 500 days). At 30 days after inhalation, 99 percent of the sacrifice body burden was in the lungs of both species. The ranges of cumulative radiation dose to the hamster lungs 30 days after inhalation were calculated to be 80 to 170, 220 to 540, and 830 to 2120 rads for initial lung burden levels of 10 to 30, 30 to 70, and 180 to 260 nCi/g, respectively. By 120 days, these doses were calculated to be 40 to 350, 500 to 710, and 1440 to 2170 rads. Hamsters with the highest lung burdens had a median survival time of about 80 days. No deaths occurred in any of the other treated hamsters or monkeys by 250 days after ^{239}Pu inhalation. Hamsters sacrificed at 30 days showed an increase in chromosome aberration frequency with increasing dose to lung of 0, 0, 0.014, and 0.089 aberrations/cell in the controls, 80 to 120, 220 to 540, and 830 to 2120 rad groups, respectively. By 120 days after inhalation, the aberration frequency in the controls was 0.012. The frequency in animals with doses that produced significant life shortening (1440 to 2170 rads) had decreased to 0.018 and to 0.032 aberrations/cell in animals with lung doses of 500 to 710 rads. At 380 days after injection of 60 nCi ^{239}Pu citrate/gm, hamster lymphocytes had an aberration frequency of 0.048 aberrations/cell. The level of chromosome damage in the $^{239}PuO_2$ exposed monkeys at 30 and 90 days after inhalation was not different than observed in controls. (auth)

6851 (LF-49, pp 170-173) RETENTION, DISTRIBUTION, AND EXCRETION OF $^{239}PuO_2$ PARTICLES LABELED WITH ^{169}Yb IN THE RHESUS MONKEY AFTER A SINGLE ACUTE INHALATION EXPOSURE. LaBauve, R. J.; Brooks, A. L.; McClellan, R. O.; Mead, D. K. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973-1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

Sixteen Rhesus monkeys were exposed to a high fired $^{239}PuO_2$ aerosol labeled with ^{169}Yb, and retention, distribution, and excretion patterns were determined. After an early rapid clearance phase, which had a half-life of less than one day, the remaining plutonium was retained in the lungs with a half-life that appeared to be greater than 500 days. By 30 days after exposure, 99 percent of the ^{239}Pu in the body was in the lungs. At this time, 6 to 10 percent of the ^{169}Yb burden was in the carcass and skeleton suggesting that there was dissociation of some ^{169}Yb from the particles. The remaining ^{169}Yb activity was in the lungs. There was little ^{239}Pu in the liver, bone, or lymph nodes. The particulate material was cleared rapidly from the gastrointestinal and upper respiratory tracts and appeared in feces over the first four days. The level of ^{239}Pu in feces returned to background by six days. Urinary excretion of ^{239}Pu reached a peak by 8 to 10 days and then remained at a constant rate throughout the remainder of the experiment. These data are useful in calculating radiation dose to a variety of organs and relating this dose to the appearance of late effects from inhaled alpha-emitting particles. (auth)

6852 (LF-49, pp 174-178) EFFECT OF MICRODOSE DISTRIBUTION ON CHROMOSOME ABERRATION FREQUENCY IN LIVER CELLS OF THE CHINESE HAMSTER FOLLOWING EXPOSURE TO $^{239}PuO_2$ OR $^{238}PuO_2$ PARTICLES. Brooks, A. L.; Peters, R. F.; Retherford, J. C. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973-1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

Chinese hamsters were injected intravenously with $^{239}PuO_2$ or $^{238}PuO_2$ particles of known size or with ^{238}Pu citrate to determine the effect of particle size and specific activity on the frequency and distribution of chromosome damage in the liver. Three particle sizes were used in the $^{239}PuO_2$ experiment: 0.15, 0.44, and 0.89 mu m, and all animals were injected with a constant activity, 5×10^{-4} muCi ^{239}Pu/gm body weight. The $^{238}PuO_2$ was injected in three particle sizes, 0.17, 0.41, and 1.1 mu m and at three activity levels. The ^{238}Pu citrate was injected at 5×10^{-3} muCi ^{238}Pu/gm body weight. Hamsters injected with $^{239}PuO_2$ were sacrificed at 15, 42, and 122 days after injection and those injected with either $^{238}PuO_2$ or ^{238}Pu citrate were sacrificed 12 days after injection. The approximate sizes and distribution of particles were determined by autoradiographic methods. The number of alpha tracks/star increased as a function of the particle size injected. A change in particle size with time was noted as smaller particles were aggregated into larger ones by the phagocytic action of Kupffer cells. Injection of $^{239}PuO_2$ and $^{238}PuO_2$ produced a distribution of chromosome damage which was non-poison in nature. $^{239}PuO_2$ produced increased damage with increasing average dose with some cells containing a large number of aberrations, but there was relatively little particle size effect. Conversely, aberration frequencies after $^{238}PuO_2$ injection were inversely related to particle size and no cells were seen with large amounts of damage. The ^{238}Pu citrate produced 6×10^{-3} aberrations/cell/rad which was a higher rate than observed for ^{238}Pu particles. This rate is similar to that observed previously for ^{239}Pu citrate. Risk for the production of cellular damage in the liver was greater per mu Ci following injection of either ^{238}Pu or ^{239}Pu citrate than it was following deposition of the same amount of $^{239}PuO_2$ or $^{238}PuO_2$ particles. (auth)

6853 (LF-49, pp 206-210) PULMONARY INFLAMMATORY RESPONSE: CELLULAR EVENTS IN EXPERIMENTAL PULMONARY ARTERIAL HYPERSENSITIVITY DISEASE. Slauson, D. O.; Dahlstrom, M. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973–1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

Horseradish peroxidase (HRP) or bovine serum albumin (BSA) were covalently linked to polyacrylamide or agarose beads and

were injected into control Syrian hamsters and hamsters previously immunized with either HRP or BSA. Animals sensitized to soluble antigen and subsequently challenged intravenously with the same antigen immobilized on beads developed an acute focal inflammatory response within 2 to 6 hours after injection. The acute response involved local deposition of IgG and complement (beta 1A/beta 1C globulin), polymorphonuclear leukocyte exudation, and variable amounts of hemorrhage. A focal vasculitis was occasionally present. Within 72 hours, the reaction had become largely mononuclear or granulomatous in nature, and giant cell formation was seen within 4 days after immobilized antigen injection. Severe reactions developed only upon recognition of specific antigenic determinants; thus hamsters immunized against soluble HRP developed characteristic lesions only upon intravenous challenge with HRP-coated beads but not with beads coated with unrelated antigen (BSA). The beads elicited only a mild foreign body reaction in the control hamsters at 5 to 7 days after injection, a reaction that was temporally and histopathologically distinct from the lesions in immunized hamsters. Thus, the state of existing immunity can influence the character and severity of the local pulmonary inflammatory response. (auth)

6854 (LP-49, pp 223-224) EFFECT OF HALOTHANE ON HAMSTER LUNG LIPIDS. Escobedo, L.; Clayton, M. H.; Henderson, R. F. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973–1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

Multiple exposure of hamsters to halothane anesthesia decreased the free fatty acid content of the lung. The study emphasizes the importance of adequate controls in any lipid studies in which anesthesia is used. (auth)

6855 (LF-49, pp 225-228) PULMONARY TISSUE AND SURFACTANT CHANGES IN SYRIAN HAMSTERS AFTER INHALATION OF ^{90}Y IN FUSED CLAY PARTICLES. Pfleger, R. C.; Waide, J. J.; Henderson, R. F.; Pickrell, J. A.; Benjamin, S. A.; Cuddihy, R. G. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973–1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

Syrian hamsters received an average of 6900 rads to lung following inhalation of an aerosol of ^{90}Y in fused clay. Animals were sacrificed in groups of four from 2 to 33 weeks post-inhalation. Controls were exposed to stable Zr in fused clay. By 8 weeks post-inhalation, total lung lipids were significantly increased (28 mg/100 g Body Weight) above the mean of the control group (21 mg/100 g B.W.) but decreased toward control levels for the remainder of the experiment. Lipid content of lung surfactant obtained by pulmonary lavage decreased from 0.93 mg/100 g B.W. to an average of 0.63 mg/100 g B.W. but more importantly, the highly surface active acetone precipitable phospholipids decreased from 0.57 ± 0.12 mg/100 g B.W. to 0.33 ± 0.09 mg/100 g B.W. during the experimental period. This change in surfactant lipid content was reflected in alterations in the surface tension properties of the pulmonary surfactant system which is intimately involved in pulmonary dynamics and alveolar stability. (auth)

6856 (LF-49, pp 233-236) COLLAGEN METABOLISM RESPONSE OF DIFFERENT LUNG AREAS AFTER INHALATION OF BETA-EMITTING RADIOISOTOPES. Pickrell, J. A.; Schnizlein, C. T.; Hahn, F. F.; Snipes, M. B.; Jones, R. K. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973–1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

Pulmonary collagen metabolism was studied in 40 dogs exposed to ^{90}Y, ^{91}Y, ^{144}Ce, or ^{90}Sr in fused clay particles. Specific areas of the lung demonstrated radiation-induced fibrosis which varied with the radiation dose pattern; ^{144}Ce and ^{90}Sr clay produced more uniform patterns of pulmonary damage than did ^{90}Y or ^{91}Y clay. Fibrosis was more severe in intermediate than in other areas of the lungs of dogs exposed to ^{90}Y clay. This was consistent with the relatively greater dose delivered to the peribronchiolar region during the early clearance of ^{90}Y. The collagen synthesis and degradation responses indicated the presence of previously formed and actively forming scars. These results indicate that the pathogenesis of pulmonary fibrosis may include initial collagen degradation followed by increased synthesis, increased accumulation of collagen, and then a return to normal synthesis. Sufficiently high dose rates during early time after exposure may be important in eliciting pulmonary fibrosis. (auth)

6857 (LF-49, pp 240-242) FLUORESCENT ANTIBODY STUDIES OF ALPHA-1-ANTITRYPSIN IN ADULT HUMAN LUNG. Tuttle, W. C.; Jones, R. K. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973–1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

The distribution of alpha-1-antitrypsin in frozen sections prepared from four specimens of human lung was determined by the indirect fluorescent antibody technique. Three of the specimens were obtained directly from surgical procedures and were peripheral tissue excised with tumors. Specific fluorescence for alpha-1-antitrypsin was observed lining the terminal airways and alveoli throughout the sections from two of the cases. In the other cases, a few focal areas of specific fluorescence were observed. The results of this study indicate that alpha-1-antitrypsin may be distributed in lung in association with pulmonary surfactant and that local tissue concentrations of alpha-1-antitrypsin are variable. (auth)

6858 (LF-49, pp 243-246) ALPHA-1-ANTITRYPSIN STUDIES: CANINE SERUM AND CANINE SURFACTANT PROTEIN. Tuttle, W. C.; Slauson, D. O.; Dahlstrom, M.; Gorman, C. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973–1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

Canine serum alpha-1-antitrypsin was isolated by gel filtration and affinity chromatography and characterized by polyacrylamide gel electrophoresis and immunoelectrophoresis. Measurement of the trypsin inhibitory capacity of the separated protein indicated a ninefold concentration of functional trypsin inhibitor during the isolation procedure. Electrophoresis demonstrated the presence of a single protein with alpha-globulin mobility and a molecular weight near that of human alpha-1-antitrypsin. The trypsin inhibitory capacity of pulmonary surfactant protein from five Beagle dogs was measured, related to total surfactant protein concentration, and compared with similar measurements on whole serum from the same animals. Results indicated a variable concentration of trypsin inhibitor in the canine pulmonary surfactant protein. However, the concentration in the surfactant protein was always significantly higher than that in the corresponding serum sample. Preliminary experiments designed to separate the trypsin inhibitory fraction(s) from the other surfactant proteins by gel filtration chromatography indicated that the trypsin inhibitor was probably a single protein with a molecular weight near that of alpha-1-antitrypsin. (auth)

6859 (LP-49, pp 252-256) EFFECT OF ENZYME-INDUCED PULMONARY EMPHYSEMA IN SYRIAN HAMSTERS ON THE DEPOSITION AND RETENTION OF INHALED PARTICLES. Hahn, F. F.; Hobbs, C. H. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973–1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

Experimental emphysema was induced in Syrian hamsters by intratracheal injection of elastase or by inhaled papain aerosols. Control hamsters were injected with saline or exposed to enzyme diluent aerosols. After 3 weeks, all groups were simultaneously exposed to an aerosol of relatively insoluble ^{137}Cs in fused clay particles with an activity median aerodynamic diameter of 1.4 to 1.6 and a geometric standard deviation of 1.6. The initial pulmonary deposition of particles (measured 3 hours after inhalation) was significantly lower in treated hamsters, 45 percent of controls with elastase and 65 percent with papain aerosols. The whole-body retention curves for each group could be fitted to three component exponential equations. The first component was a major portion, 78 to 83 percent, of the initial body burden in all groups and cleared rapidly with a half-time of 0.9 to 1.2 days. The second component was 11 to 13 percent of the IBB. In the enzyme treated hamsters the clearance of this component was much faster than controls, 9 and 16 day half-time compared with a 31 and 46 day half-time. The long-term component was 4 and 5 percent of the IBB in enzyme treated hamsters and 8 and 9 percent of the IBB in control animals. The enzyme treatments resulted in a prolonged half-time in the last component of 185 and 244 days compared to 140 and 160 days for the control hamsters. The effect of both enzyme treatments on the retention of particles was similar in spite of the fact that the pulmonary lesions were not the same. Elastase I.T. caused a diffuse destruction and enlargement of alveoli with a loss of pulmonary elastic recoil. Papain aerosols caused a focal destruction and enlargement of alveoli with no loss of elastic recoil. The common feature of both lesions was an increased number of alveolar macrophages which may account for the early increased clearance of particles. The prolonged retention of particles may be due to focal accumulations of macrophages in distal alveoli. (auth)

6860 (LF-49, pp 257-260) INFLUENCE OF PARTICLE SIZE ON PHAGOCYTOSIS BY RABBIT ALVEOLAR MACROPHAGES IN VITRO. Hahn, F. F.; Newton, G. J.; Springstead, K. L.; Cordes, J. C. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973–1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

Phagocytosis of particles deposited deep in the lung may play an important role in the ultimate fate of the particle. Monodisperse aerosols of montmorillonite fused clay particles ranging from 0.32 to 2.02 mu m in diameter, have been used to test the phagocytic capabilities of rabbit alveolar macrophages in vitro. Using ^{169}Yb-labeled particles, it has been shown that free particles can be separated from phagocytized particles and the percentage of phagocytosis determined. Preliminary results indicate that a greater percentage (20 to 40 percent) of the larger particles (0.97 to 2.02 mu m) are phagocytized than the smaller particles (0.32 to 0.35 mu m) (0 to 10 percent). In addition, this phagocytosis has been shown to be energy dependent and require glycolysis. Oxidative phosphorylation is not necessary for phagocytosis of these particles by rabbit alveolar macrophages. (auth)

6861 (LF-49, pp 269-273) BRONCHOPULMONARY LAVAGE AND DTPA TREATMENT FOR THE REMOVAL OF INHALED ^{239}Pu OF VARIED SOLUBILITY IN BEAGLE DOGS. II. Muggenburg, B. A.; Mewhinney, J. A.; Miglio, J. J.; Slauson, D. O.; McClellan, R. O. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973–1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

The efficacy of bronchopulmonary lavage and chelation therapy was determined for removing ^{239}Pu from Beagle dogs after inhalation of ^{239}Pu aerosols of differing in vivo solubility. The four aerosols used were nebulized from a solution of $^{239}PuCl_4$ and heat treated at temperatures of 325, 600, 900, and 1150°C, respectively. Six dogs were exposed to each of the four aerosols and three dogs in each group were treated subsequently by lavage and intravenous diethylenetriaminepentaacetic acid (DTPA); three dogs served as untreated controls. Tissue accumulation of ^{239}Pu in the untreated control dogs at sacrifice 56 days post-exposure, expressed as a percentage of the initial lung burden (ILB), was 6 percent in liver and 9 percent in skeleton for the 325°C aerosol group, 1 percent in liver and 2 percent in skeleton for the 600°C group, and less than 0.6 percent in these tissues for the 900° and 1150°C aerosol groups. Tissue accumulation was 1.0 percent or less of the ILB for all organs in the treated groups of dogs. The urinary excretion of ^{239}Pu was increased in the treated dogs compared to the control dogs that inhaled the 325°C and 600°C aerosols and was low in all dogs exposed to the 900° and 1150°C treated aerosol particles. Ten bronchopulmonary lavage procedures removed a mean of 44 percent of the ILB of ^{239}Pu from the lungs. The aerosol temperature and resulting differences in solubility of the particles did not influence the efficacy of the lavage procedure. An in vitro solubility test predicted the relative in vivo solubility of the four aerosols. These results are discussed in relation to the choice of therapy and its timing. (auth)

6862 (LF-49, pp 274-276) REMOVAL OF INHALED ^{241}Am FROM THE BEAGLE DOG BY LUNG LAVAGE: A PILOT STUDY. Muggenburg, B. A.; Mewhinney, J. A.; Miglio, J. J.; Slauson, D. O. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973–1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

The purpose of this pilot study was to obtain information on the relative effectiveness of lung lavage and intravenous chelation therapy on the removal of ^{241}Am from the dog. Six Beagle dogs were divided into two equal groups; the first group was exposed by inhalation to monodisperse particles of ^{241}Am, 1.8 mu m AD. The second group was exposed to a polydisperse aerosol. Two dogs in each group were treated by lung lavage on days 2 and 9 post-exposure and diethylenetriaminepentaacetic acid (DTPA) on days 1, 2, 3, 4, 7, and 9. Lung lavage treatment removed 24 percent of the initial lung burden of ^{241}Am and DTPA increased urinary excretion to more than 15 percent of the initial lung burden during the 16 days of the study. Translocation of ^{241}Am to liver and skeleton occurred in the control dogs, 6 to 17 percent of the ILB, but less than 2 percent translocated to these organs in the treated dogs. (auth)

6863 (LF-49, pp 281-283) COMPARISON OF DOUBLE AND SINGLE LUMEN CATHETERS FOR REMOVING INHALED ^{169}Yb IN DOGS BY BRONCHOPULMONARY LAVAGE. Felicetti, S. A.; Silbaugh, S. A.; Muggenburg, B. A. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973–1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

This study was performed to compare the effectiveness of two methods of bronchopulmonary lavage for removing inhaled particles from the lung. Six dogs were exposed to aerosols of ^{169}Yb-tagged $^{238}PuO_2$ and underwent bilateral bronchopulmonary lavage on days 2 and 9 post-exposure. Initial lung burdens (ILB) of ^{169}Yb ranged from 0.30 to 0.90 mu Ci. The dogs were divided into two groups: one was lavaged using a double lumen catheter and the other was lavaged by a new method using a single lumen catheter. The percentage of the ^{169}Yb ILB removed was similar for both lavage techniques. Mean removal for the single lumen technique was 33 percent as compared to 38 percent for the double lumen technique. (auth)

6864 (LF-49, pp 284-287) METHOD OF LUNG LAVAGE USING A SINGLE LUMEN ENDOTRACHEAL TUBE. Muggenburg, B. A.; Mauderly, J. L. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973–1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

The physiological response of the cardiopulmonary system of the dog during and after bronchopulmonary lavage via a single lumen endotracheal tube was evaluated. The five Beagle dogs used in the study were prepared for lavage by anesthetization, vascular cannulation, intubation with a single lumen endotracheal tube, and hyperventilation with 100 percent oxygen. Lavage was performed with the dog on its side by slowly introducing saline to the volume of one-half the total lung capacity and then draining the lung immediately by gravity. After brief ventilation, the lavage sequence was repeated four times. The dog was turned to the opposite side, and the washing sequence repeated. The heart rate slowed but pulmonary and systemic arterial mean pressures did not change. The P/sub O_2/ decreased from 317 to 107 mmHg during the procedure, but P/sub CO_2/ remained below 40 mmHg. Pulmonary function tests at 24 hr after lavage revealed only a few mild changes in breathing pattern and gas exchange, and by 168 hr did not differ significantly from prelavage values. (auth)

6865 (LF-49, pp 289-292) BRONCHIAL TREE STRUCTURE IN THE HUMAN, BEAGLE, RAT, AND HAMSTER. Phalen, R. F.; Yeh, H. C.; Velasquez, D. J. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973–1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

Partial results of an extensive study of airway morphology are presented. Bronchial tube branching angles, lengths, and diameters were measured on replica casts of lungs from humans, dogs, rats, and a hamster. Each cast of silicone moulding compound was cured in the thorax of the subject, checked for artifacts and hand pruned before measurement. A total of about 150,000 morphometric measurements were made based on a conceptual model of airway branches. Data presented include number of divisions in the bronchial tree in various lobes, and the changes in branching geometry seen as one progresses deeper into a lobe. Significant differences in structure were found between species, from lobe-to-lobe within a lung and with depth within a lobe. The humans had bronchi that were longer in relation to their diameters and had more symmetric bifurcations with respect to diameter ratios and branch angle ratios than the other species. (auth)

6866 (LF-49, pp 293-297) DEPOSITION OF MONODISPERSE PARTICLES IN SMALL RODENTS. Raabe, O. G.; Yeh, H. C.; Newton, G. J.; Phalen, R. F.; Velasquez, D. J. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973–1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

Hamsters and rats have been exposed to monodisperse aerosols of spherical aluminosilicate particles (rho equals 2.2) labeled with ^{169}Yb to determine the inhalation deposition and organ distribution with respect to particle size. Ten animals of each species were exposed to five aerodynamic equivalent diameters: (a) 3.15 mu m, (b) 2.19 mu m, (c) 1.14 mu m, (d) 0.61 mu m, and (e) less than 0.3 mu m. Five animals were exposed simultaneously for twenty minutes with automatic recording of respiratory rates and volumes using individual whole-body plethysmographs. Three were sacrificed immediately after the exposure and the remaining 2 after 20 hours had elapsed for radioanalysis of selected tissues to determine deposition quantities and organ distribution. The deposition fractions for the various aerosols in the various parts of the respiratory tract are summarized. Relative deposition among the various lung lobes showed remarkable consistency with respect to particle size. (auth)

6867 (LF-49, pp 298-302) MATHEMATICAL CONSIDERATIONS FOR PARTICLE DEPOSITION IN THE TRACHEOBRONCHIAL TREE: EQUATIONS AND LUNG MODEL. Yeh, H. C.; Hulbert, A. J.; Phalen, R. F.; Raabe, O. G. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973–1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

A geometrical lung model generated by a Monte-Carlo technique for use in a theoretical study of particle deposition in the respiratory tract is described. This lung model has two main advantages over existing lung models; (1) lung characteristics reflect actual lung morphometry rather than requiring an oversimplified regular tree-like lung structure, (2) particle deposition in each lobe of the lung can be calculated separately which cannot be accomplished in existing lung models. From a consideration of the flow inside the respiratory tract, a set of equations has been chosen for application in deposition calculations. (auth)

6868 (LF-49, pp 303-306) CRITERIA FOR INHALATION EXPOSURE SYSTEMS UTILIZING CONCURRENT FLOW SPIROMETRY. Raabe, O. G.; Yeh, H. C. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973–1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

Principles are given for the design and operation of a new class of inhalation exposure systems utilizing concurrent flow spirometry (CFS), a simple method for providing realtime measurement of respiratory volumes and rates during inhalation exposure by mouth or nose of individual experimental animals or man to aerosols or gases. This technique is especially useful for inhalation exposure of larger experimental animals, such as horses, where whole-body plethysmography is usually impractical. Difficulties encountered with conventional exposure systems in maintenance of uniform aerosol or gas concentrations and prevention of large pressure excursions in the exposure chamber during breathing are obviated by systems utilizing the principles of concurrent flow spirometry. For illustration, two exposure units with CFS are described, one for exposure of Beagle dogs and one for ponies. (auth)

6869 (LF-49, pp 307-313) REPEATED INHALATION EXPOSURE OF MICE TO $^{144}CeO_2$. II. Lundgren, D. L.; McClellan, R. O.; Hahn, F. F.; Sanchez, A.; Newton, G. J. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973–1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

Mice were repeatedly exposed by inhalation to aerosols of $^{144}CeO_2$ at 60-day intervals for seven consecutive exposures to maintain initial lung burdens (ILB) of ^{144}Ce following each exposure near 0.2, 1.0, or 4.5 mu Ci. Additional groups of mice were exposed only once to achieve ILBs of 0.2, 1.0, or 4.5 mu Ci when 70 days of age and once to achieve ILBs of 1.0 or 4.5 mu Ci when either 260 or 450 days of age. Control mice consisted of those exposed once or repeatedly to stable CeO_2, sham exposed once or repeatedly and nontreated mice. Clearance of newly deposited ^{144}Ce during the first 7 days was slightly decreased during the course of repeated inhalation exposure and slightly decreased in mice exposed once at increased ages. Long-term retention of ^{144}Ce in mice exposed once did not appear to vary with the age at exposure but sufficient data are not yet available to determine the effect of repeated exposure on the long-term retention of ^{144}Ce. The 50 percent survival time was significantly shortened in mice repeatedly exposed to $^{144}CeO_2$ as compared with mice exposed once and the controls. Cumulative absorbed radiation dose to lung was 4 to 8 times greater in the repeatedly exposed animals than in those with comparable ILBs that were only exposed once. Dose rates and cumulative doses in some of the repeatedly exposed mice were similar to those in a Beagle dog that died with a pulmonary hemangiosarcoma 765 days after a single inhalation exposure. One squamous cell carcinoma and one adenocarcinoma were found upon examination of the lungs of 52 repeatedly exposed mice that died between 14 and 373 days after the initial exposure. These represent the first pulmonary tumors we have observed in mice exposed by inhalation to an insoluble form of ^{144}Ce. (auth)

6870 (LF-49, pp 318-321) RETENTION PATTERNS IN BEAGLE DOGS REPEATEDLY EXPOSED TO AEROSOLS OF ^{137}Cs-LABELED FUSED CLAY PARTICLES. II. Boecker, B. B.; Thomas, R. G.; McClellan, R. O. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973–1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

To provide an experimental evaluation of the adequacy of extrapolating single inhalation exposure kinetics to the repeated exposure situation, 12 Beagle dogs were given 10, 20, or 40 weekly, 10-min inhalation exposures to ^{137}Cs in fused clay particles. Whole-body counting immediately before and after each exposure and at other intervals has been used to assess the kinetics of buildup and retention of the deposited material. Current analyses indicate that neither the deposition percentage nor the rate of buildup of ^{137}Cs in the lung was affected by the number of exposures. Two dogs each were sacrificed at 7 days after 10, 20, or 40 inhalation exposures. Tissue analyses indicated that 96 percent of the body burden was in the lung, 0.3 to 1 percent in the tracheobronchial lymph nodes, and the remainder mainly in other soft tissues. Preliminary analysis of the whole-body retention data obtained after the last inhalation exposure for the six remaining living dogs indicates that the ^{137}Cs is being retained somewhat more tenaciously than was observed in dogs that received a single inhalation exposure to a similar aerosol. Observations are continuing on these six dogs. (auth)

6871 (LF-49, 323-328) CHARACTERIZATION OF AEROSOLIZED CONSUMER PRODUCTS. Mokler, B. V.; Henderson, T. R. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973–1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

The use of pressurized products is accompanied by the production of respirable particles that may be inhaled by the product user. Whether these particles represent an inhalation hazard depends on several factors. Preliminary data indicate that many products produce breathing zone particulate concentrations of 0.1 mg/l or greater; these particles are generally in the respirable size range. Another factor that must be considered in determining potential hazard is the complex nature of commercial products. The relation between the composition of the product as formulated and the respirable particulates is a further complication in estimating potential hazard. (auth)

6872 (LF-49, pp 329-331) INHALATION TOXICOLOGY RESEARCH INSTITUTE COMPUTER SYSTEM. Hulbert, A. J.; Crain, C. R. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973–1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

A new computer system (PDP-11/45, Digital Equipment Corporation) has been installed at the Inhalation Toxicology Research Institute to process and store all experimental data. Advantages of this in-house, disk-oriented system are contrasted with previous time-sharing operations on a magnetic-tape oriented, Burroughs B5500 computer. An information storage and retrieval system is being programmed that will permit each investigator to interact directly with his data without dependence on a programmer. On-line operation of various pieces of radioanalytical equipment will also be possible with this new system. Preliminary operation of the computer has highlighted several shortcomings; planned changes during the next 6 months to alleviate these problems are described. (auth)

6873 (LF-49, pp 332-335) EVALUATION OF THE INHALATION TOXICOLOGY RESEARCH INSTITUTE BEAGLE DOG CLOSED BREEDING COLONY: A PROGRESS REPORT. Lustgarten, C. S.; Hobbs, C. H.; Muggenburg, B. A.; Benjamin, S. A.; Slauson, D. O.; Hahn, F. F. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973–1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

Since early 1968, a closed breeding colony has been in operation at the Inhalation Toxicology Research Institute to produce experimental dogs for inhalation toxicology studies and to replace colony breeding stock for producing dogs with a stable gene pool. From March 1, 1968 through July 15, 1974, 123 bitches were bred 613 times, resulting in 540 litters and 2809 puppies: a conception rate for this period of 88.9 percent. An average of 3.74 pups survived to one year of age. (auth)

6874 (NERC-LV-539-36) ACTINIDE CONCENTRATIONS IN TISSUES FROM CATTLE GRAZING NEAR THE ROCKY FLATS PLANT. Smith, D. D.; Black, S. C. (National Environmental Research Center, Las Vegas, Nev. (USA)). Feb 1975. Contract AT(26-1)-539. 47p. Dep. NTIS $5.45.

Concentrations of uranium, ^{239}Pu, and ^{241}Am were measured in various tissues from ten cattle collected from a herd which grazed on a pasture just east of the U. S. Atomic Energy Commission Rocky Flats Plant, Colorado. The ^{239}Pu concentrations were statistically equivalent to those found in other herds grazing in areas where the plutonium in soil was above the U. S. average level. The americium concentrations were about ¼ to ½ of the plutonium-239 concentrations in the same tissues. The uranium concentrations in tissues were slightly higher than in most of the other cattle herds studied thus reflecting the higher environmental concentrations of uranium on the eastern slope of the Rockies. The uranium and plutonium concentrations in lung and tracheo-bronchial lymph nodes and calculations of expected concentrations from atmospheric plutonium measurement suggest that inhalation contributes some fraction of the exposure of the cattle. The levels of both uranium and plutonium-239 found in the cattle are similar to those found in the general U. S. population from fallout. Assuming a human consumes 500 grams/day of liver or muscle containing the maximum measured actinide concentrations, the human bone dose accumulated in 50 years of ingestion is estimated to be 0.02 rem, an insignificant fraction of the 8.5 rem background dose accumulated by Denver residents in that time. (auth)

6875 IN VIVO DISTRIBUTION OF VESICLES LOADED WITH RADIOPHARMACEUTICALS: A STUDY OF DIFFERENT ROUTES OF ADMINISTRATION. McDougall, I. R.; Dunnick, J. K.; Goris, M. L.; Kriss, J. P. (Stanford Univ. Medical Center, CA). J. Nucl. Med.; 16: No. 6, 488-491 (Jun 1975).

The in vivo distribution of vesicles containing radiopharmaceuticals in their cavities has been studied using three routes of administration: intravenous, subcutaneous, and intraperitoneal. The in vivo distribution in mice was determined by dissection of the animals and calculation of radioactivity in the organs. In rats the in vivo distribution was assessed by scintigraphy using a scintillation camera-digital computer unit. After intravenous

injection of vesicles, radioactivity is concentrated to some extent in the liver and spleen but the pattern of distribution is different from that of the corresponding free radiopharmaceutical or radiocolloid made of the corresponding radionuclide. The permeability of the vesicular membrane to contained radiopharmaceutical has been shown to vary according to the chemical composition of the vesicles. Vesicles can be used to introduce materials in vivo and the potential exists for their specific targeting by coupling other molecules to their surfaces. (auth)

6876 CHEMISTRY OF TECHNETIUM RADIOPHARMACEUTICALS. I. Exploration of the Tissue Distribution and Oxidation State Consequences of Technetium(IV) in Tc–Sn–Gluconate and Tc–Sn–EHDP using Carrier ^{99m}Tc. Hambright, P.; McRae, J.; Valk, P. E.; Bearden, A. J.; Shipley, B. A. (Univ. of California, Berkeley). J. Nucl. Med.; 16: No. 6, 478–482(Jun 1975).

The distribution in rats of the renal agent Tc–Sn–gluconate using both /sup 99m/Tc and carrier amounts of ^{99}Tc was similar. The same behavior was shown with the bone agent Tc–Sn–EHDP. The radiopharmaceutical consequences of the observed Tc(IV) oxidation state in these systems are explored. (auth)

6877 SELECTIVE IN VIVO INCORPORATION AND METABOLISM OF RADIOACTIVE PUTRESCINE IN THE ADULT MALE RAT. Clark, R. B.; Fair, W. R. (Stanford Univ. School of Medicine, CA). J. Nucl. Med.; 16: No. 5, 337-342(May 1975).

Putrescine (1,4, diaminobutane), a known precursor of the polyamines, spermine, and spermidine, was studied as a possible vehicle for a radioisotope scan of the prostate and other tissues rich in polyamines. Male Sprague-Dawley rats received intravenous injections (2.3 muCi/100 gm) of ^{3}H putrescine dihydrochloride (specific activity, 107 muCi/muM). One hour after injection the ventral prostate and pancreas showed uptake of radioactivity that was three and four times greater than that of the liver, respectively. The ratio of the amount of radioactivity in the ventral prostate compared with that of abdominal wall musculature was 8:1. The pancreas-to-muscle ratio was 10:1. At 1 hr the ventral prostate contained 0.6 percent (0.9 percent/gm wet wt) of the total injected radioactivity and the pancreas, 0.5 percent (1.2 percent/gm wet wt) of the injected dose. More than 90 percent of the radioactivity in the rat ventral prostate, 6 hr after intravenous injection of ^{14}C-putrescine dihydrochloride, was found to be in the form of spermine and spermidine, thus confirming previous in vitro biosynthetic studies. (auth)

Plants

Refer also to abstract 8425.

6878 DIURNAL CHANGES IN RADIONUCLIDES UPTAKE BY PHYTOPLANKTON IN SMALL-SCALE ECOSYSTEMS. Yousef, Y. A. (Florida Technological Univ., Orlando); Padden, T. J.; Gloyna, E. F. Water Res.; 9: No. 2, 181-187(Feb 1975).

A continuous release of cesium-134 and strontium-85 into a simulated river system was maintained for more than 3 weeks for the purpose of evaluating the influence of photosynthetic oxygen production on cesium and strontium uptake. The flow rates and radioisotope concentration were maintained at a constant input throughout the experiment. The flow through time in the model river system was 6 h. Samples were taken from various stations every 4 h over a 36 h time interval. Temperature, dissolved oxygen, as well as other routine measurements were made. Samples were processed for plankton count and radioactivity in both the suspended phytoplankton and the water. The uptake of ^{134}Cs by phytoplankton was related to diurnal photosynthetic production of oxygen and a linear relationship exists between rate of change in ^{134}Cs concentration and the rate of net photosynthetic oxygen production. (auth)

6879 RADIOACTIVE STIGMATIC EXUDATE PRODUCTION BY LILIUM LONGIFLORUM THUNB. STYLES LABELLED WITH 5-^{3}H-URIDINE. Campbell, R. J.; Ascher, P. D. (Minnesota Univ., St. Paul). Incompat. Newsl.; No. 5, 76-81(Feb 1975).

The stigma of the Easter lily (Lilium longiflorum Thunb.) from the day after anthesis until the petals have dried and fallen produces copious amounts of stigmatic exudate. Lily styles were labeled with 5-^{3}H-uridine and the stigmatic exudate was examined whether it contained label and whether the label occurred in nucleic acid species. (NL)

Microorganisms

6880 (COO-3474-3) CYCLING AND EFFECTS OF ^{36}Cl LABELED DDT ON SOIL INVERTEBRATES. Annual Progress Report, 1974–1975. Dindal, D. L. (State Univ. of New York, Syracuse (USA). Coll. of Environmental Science and Forestry). 1975. Contract AT(11-1)-3474. 5p. Dep. NTIS $4.00.

Results are reported from studies on the cycling of ^{36}Cl-DDT residues, the possibility of storage equilibrium, and the magnification and biological effects of residues in soil invertebrate micro-communities. (CH)

New Tracer Techniques

Refer also to abstracts 5923, 5925, 6045, 6098, 6487, 6685, 6793, 6794, 6828, 6871, 8415, and 8420.

6881 (AD/A-002480) ANNUAL REPORT IN SUPPORT OF HYPERBARIC PHYSIOLOGY RESEARCH. Annual Report No. 3, 1 September 1973–31 August 1974. Benitez, S.; Mints, W. H.; Pomerance, A. (Automation Counselors, Inc., Frederick, Md. (USA)). Oct 1974. Contract N00014-72-C-0162. 15p. (ACI-1009-7). NTIS $3.25.

The report describes advances made in the development of physiological monitoring and analysis systems for use in hyperbaric research. The systems, designed around a mini-computer configuration, are able to monitor up to 16 channels of analog data and 5 channels of data from radioisotope detectors. Both real-time and nonreal-time data analysis is included as part of the operational system. Instrumentation and software development in support of nerve pulse, cerebral blood flow, and respiration research projects are described. (GRA)

6882 (BNL-19894) SHORT-LIVED RADIOPHARMACEUTICALS FOR THE DIAGNOSIS OF OCULAR MELANOMA. Packer, S.; Lambrecht, R.; Atkins, H. L.; Wolf, A. P. (Brookhaven National Lab., Upton, N. Y. (USA)). 1974. 19p. (CONF-750318-1). Dep. NTIS $4.00.

From symposium on nuclear ophthalmology; Philadelphia, Pennsylvania, USA (7 Mar 1975).

An experimental procedure has been established to evaluate radiopharmaceuticals for the specific purpose of melanoma detection by scintiscanning. By using the Greene melanoma in the hamster several labeled compounds were compared. Specifically the tumor uptake along with detailed analyses of uptake by various parts of the eye and body were determined in a hamster model. Of those short-lived radionuclides investigated ^{203}Pb-tris was the most promising as a non-invasive localizing agent for ocular melanoma and it should prove effective for ocular scintigraphy. (auth)

6883 (BNL-20031) LOSS OF CALCIUM FROM AXIAL AND APPENDICULAR SKELETON IN PATIENTS WITH CHRONIC RENAL FAILURE. Cohn, S. H.; Ellis, K. J.; Caselnova, R. C.; Asad, S. N.; Letteri, J. M. (Brookhaven National Lab., Upton, N. Y. (USA); Nassau County Medical Center, East Meadow, N. Y. (USA). Div. of Renal Diseases). 1974. 7p. Dep. NTIS $4.00.

The widespread prevalence of bone disease in chronic renal failure both prior to and during hemodialysis is an important aspect of uremia. Loss of bone mineral of the skeleton in renal disease can be measured directly by total-body neutron activation analysis (TBNAA). The absorptiometric technique, using monochromatic photons from ^{125}I, applied to the appendicular skeleton (radius) also reflects the loss of bone mineral content (BMC) in renal disease. The results of these two techniques were compared in 25 patients with renal insufficiency, 53 with end stage renal failure on dialysis, and 24 normal control subjects. (auth)

6884 (COO–3333-10) NEW IMAGING SYSTEMS IN NUCLEAR MEDICINE. Technical Progress Report, July 1, 1974–April 1, 1975. Brownell, G. L. (Massachusetts General Hospital, Boston (USA)). 1975. Contract AT(11-1)-3333. 15p. Dep. NTIS $4.00.

Design modifications in a positron camera that improve imaging in diagnostic studies using short-lived cyclotron-produced radionuclides as tracers are described. Results are reported from clinical studies using ^{13}N for inhalation studies; ^{15}O to measure pulmonary ventilation; perfusion, and regional lung water; and the use of ^{13}N-ammonia, ^{68}Ga-microspheres, and ^{82}Rb for cardiac imaging and studies of blood flow in the brain. (CH)

6885 (COO-3399-9) DEVELOPMENT OF SCAN ANALYSIS TECHNIQUES EMPLOYING A SMALL COMPUTER. Progress Report, August 1, 1974–July 31, 1975. Kuhl, D. E. (Pennsylvania Univ., Philadelphia (USA). Dept. of Radiology). 1975. Contract AT(11-1)-3399. 7p. Dep. NTIS $4.00

Progress is reported in the development of equipment and counting techniques for transverse section scanning of the brain following the administration of radiopharmaceuticals to evaluate regional blood flow. The scanning instrument has an array of 32 scintillation detectors that surround the head and scan data are analyzed using a small computer. (CH)

6886 (LF-49, pp 179-181) LONG-TERM TURNOVER OF CHINESE HAMSTER LIVER CELLS AS DETERMINED BY THE

RATE OF LOSS OF ^{14}C-THYMIDINE FROM LIVER DNA. Brooks, A. L.; Peters, R. F.; Cuddihy, R. G. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973–1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

The rate of division and death of liver cells in the Chinese hamster was determined by measuring the change in the ratio of ^{14}C-thymidine/mg DNA in liver. Radioactive thymidine was incorporated into liver DNA by a series of intraperitoneal injections given over the first three weeks of life. There was a rapid drop in DNA per mg of dry tissue over the first 20 days of life followed by a plateau. This indicates an increase in cell size for 20 days and a constant cell size over the remainder of the experiment. The change in specific activity of ^{14}C in the DNA with time was described by the two component exponential equation Y equals 39,000 e/sup -0.031t/ + 22,000 e/sup -0.000817t/ where Y equals DPM of ^{14}C and t is time in days. This indicates that death rate of liver cells in the long-term component of the equation was 0.0817 percent per day which corresponds to a half-life of 850 days and an average life of 1220 days. In the mature animal, cell division rate is equal to cell death rate. The lifespan of a cell can be defined as the time from one cell division to the next or from cell division until death, whichever occurs first. Using this definition, the lifespan of liver cells will be equal to twice the death rate as determined by ^{14}C-thymidine loss. By 425 days of age, half of the original cells had either divided or died. This system will be useful in determining the rate of cell killing in the liver following exposure to a variety of toxic substances. (auth)

6887 (LF-49, pp 215-219) ISOLATION AND METABOLISM OF ALVEOLAR EPITHELIAL TYPE II CELLS. Pfleger, R. C.; Roddy, W. D. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973–1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

A population of pulmonary cells enriched in epithelial type II pneumonocytes was isolated from Syrian hamsters using modifications of existing technology and identified by fluorescent microscopy. Briefly, the animals were euthanized, the heart-lung-trachea was removed, the lungs perfused intravascularly and intrabronchially and then gently trypsinized during a second bronchopulmonary lavage to free the epithelial components. The lungs were minced, the cell suspension filtered, the trypsin deactivated, the cell suspension refiltered, and the cells concentrated by centrifugation before separation on a discontinuous gradient of Ficoll. The enriched population of epithelial type II cells concentrated at the 1.058 to 1.090 interface. Incubation of these cells with alpha-glycerol (U-^{14}C) phosphate for various times showed a linear uptake for 2 hours of the carbon-14 into triglycerides, phosphatidyl choline, and phosphatidyl glycerol which were identified in the total lipid extract by thin-layer chromatographic zonal scanning and liquid scintillation spectrometry. (auth)

6888 (LA-49, pp 220-222) CRYOCHROMATOGRAPHY: A METHOD FOR THE SEPARATION OF PHOSPHOGLYCERIDES ACCORDING TO THE NUMBER AND LENGTH OF SATURATED FATTY ACID COMPONENTS. Henderson, R. F.; Clayton, M. H. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973–1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

A thin layer chromatographic method utilizing ultracold temperatures has been developed to separate phosphoglycerides containing only long-chain saturated fatty acids from phosphoglycerides containing fatty acids with any degree of unsaturation. The method is direct, nondiluting, and nondestructive. Since the surfactant lipids found in lung contain only long-chain, saturated fatty acids, the method should be particularly useful to those in lung lipid research. Studies on the uptake of labeled precursors into the lung surfactant lipids as well as work on quantitation of surfactant lecithins in the lung can be facilitated by this method. (auth)

6889 (LF-49, pp 265-268) NITROGEN DILUTION CONSTANT: A METHOD OF CORRECTING FOR BREATHING PATTERN CHANGES WHEN ANALYZING NITROGEN CLEARANCE CURVES. Mauderly, J. L. Dec 1974.

In Inhalation Toxicology Research Institute annual report, 1973–1974. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. (USA)).

Nitrogen clearance curves of unsedated Beagle dogs were constructed by plotting sequential end-expiratory nitrogen peaks (FETN2) against breath number during open circuit measurements of functional residual capacity (FRC). Curves were analyzed graphically and the slope of the main component was described in terms of B½, the number of breaths used to lower FETN2 to ½ its original value. The value of B½ was directly proportional to the quantity (FRC/V/sub T/). The quantity (B½/(FRC/V/sub T/)) was relatively constant for normal individuals regardless of FRC or V/sub T/, and was called the "nitrogen dilution constant" (NDC). The means and ranges of V/sub T/, FRC, B½, and NDC were determined for normal dogs. The use of NDC in comparing baseline and post-treatment washout curves is demonstrated. (auth)

6890 DETERMINATION OF RED CELL SURVIVAL BY ACTIVATION ANALYSIS. Akiba, H.; Uchiyama, G.; Kakehi, H. (Chiba Univ. (Japan). School of Medicine). Radioisotopes (Tokyo); 23: No. 8, 455-458(Aug 1974). (In Japanese).

The determination of red cell survival by activation analysis using non-radioactive enriched ^{50}Cr was clinically applied. The method described is very practical with the use of a lithium-drifted germanium detector which avoids chemical separation after neutron irradiation. Though there were scatterings in individual data points, fairly good agreements were obtained between half-lives of ^{50}Cr-labeled red cells and those of ^{51}Cr-labeled red cells. (auth)

6891 A COMPARISON OF IN VIVO CONCENTRATIONS OF ^{67}Ga-CITRATE AND ^{57}Co-BLEOMYCIN IN TUMOR USING A SEMICONDUCTOR DETECTOR. Higashi, T.; Aoyama, W. (Kanagawa Dental Coll., Yokosuka (Japan)); Tomura, K.; Ito, H.; Nakamura, K. Radioisotopes (Tokyo); 23: No. 8, 459-466(Aug 1974). (In Japanese).

Cobalt-57-labelled bleomycin was recently introduced by Nouel and Kono for detecting the localization and extent of tumors in humans. It is apparent from the scintigram of a case of lung cancer that the tissue distribution of ^{67}Ga-citrate and ^{57}Co-bleomycin is different. Although ^{57}Co-bleomycin showed greater tumor specificity in this clinical case, exact comparison is impossible for the examinations were performed one month apart. The purpose of this paper is to report the comparison of in vivo concentration in tumor of ^{67}Ga-citrate and ^{57}Co-bleomycin using a Ge(Li) semiconductor detector. This method made it possible to detect ^{67}Ga and ^{57}Co simultaneously and to estimate their relative uptakes, and thus minimize the differences due to individual variations. The accumulation of ^{67}Ga-citrate in metastatic lymph node of patients with lung, breast cancer and reticulosarcoma was 4 to 20 times higher than that of ^{57}Co-bleomycin. Especially, the accumulation of ^{67}Ga-citrate in reticulosarcoma was remarkably higher than that of ^{57}Co-bleomycin. The accumulation of ^{67}Ga-citrate in normal liver was 24 times higher than that of ^{57}Co-bleomycin. These results were the same as those obtained by the animal experiments. After treatment of ^{60}Co radiation therapy (7000 R), the accumulation of ^{67}Ga-citrate in lung cancer strongly decreased, whereas that of ^{57}Co-bleomycin not so much decreased. The method used in this study is a new application of a semiconductor detector in nuclear medicine. (auth)

6892 TECHNICAL EVALUATION OF RES-O-MAT ETR TEST. Kamei, F.; Suzuki, S.; Shidara, M. (Sendai Railway Hospital (Japan)). Kotsu Igaku; 28: No. 1, 40-50(Jan 1974). (In Japanese).

A salient feature of the Res-o-Mat test is that both the values of T-4 and intake of T-3 can be simultaneously calculated. In this paper, technical evaluations were described according to the respective items. Mixing time (15 seconds), did not influence the value of ETR even if it was prolonged or shortened. The ratio of alcohol volume to the serum has to be kept at 2:1 for extraction of T-4. The relative volume changes of standard serum and that of the patient did not affect the value of ETR for practical purposes. The variation of the serum volume added to the definite alcohol quantity. It was evidenced that ETR indicated the lower value by increase of the additional quantities of serum. Incubation time (60 minutes) was adequate unless the variety is wide. Finally, it was evaluated that the relative changes in the technical course caused only minimum error which was negligible. (auth)

6893 L-ASCORBIC ACID SULFATE ESTERS WITH SPECIAL REFERENCE TO ENZYMATIC HYDROLYSIS. Hatanaka, H.; Ogawa, Y.; Egami, F. (Mitsubishi Chemical Industries, Ltd., Tokyo (Japan)). J. Biochem. (Tokyo).; 75: No. 4, 861-866(Apr 1974).

L-Ascorbic acid 6-sulfate was synthesized as an analog for natural L-ascorbic acid 2-sulfate by the direct sulfation of L-ascorbic acid with pyridine-sulfur trioxide. Its ultraviolet, infrared, and nuclear magnetic resonance spectra were investigated and compared with those of L-ascorbic acid 2-sulfate. A crude sulfatase preparation from the liver of a marine gastropod, Charonia lampas, hydrolyzed L-ascorbic acid 2-sulfate to give L-ascorbate and sulfate. L-ascorbic acid 6-sulfate was also, although more slowly, hydrolyzed by this enzyme preparation. (auth)

6894 STUDIES ON RAT LIVER CATALASE. VII. Double-Labeling of Catalase by ^{14}C-leucine and ^{3}H-delta-aminolevulinic Acid. Higashi, T.; Kawamata, F.; Sakamoto, T. (Showa Univ.,

Tokyo (Japan). School of Pharmaceutical Sciences). J. Biochem. (Tokyo).; 76: No. 4, 703-708(Jul 1974).

To investigate the mechanism of incorporation of heme into newly-synthesized catalase [EC 1.11.1.6], rat liver catalase was labeled simultaneously with ^{14}C-leucine and ^{3}H-δ-aminolevulinic acid both in vivo and in vitro. The kinetics of incorporation of ^{3}H of injected δ-aminolevulinic acid into catalase on ribosomes were the same as those of incorporation of ^{14}C-leucine. In a cell-free system newly-synthesized catalase was found to be labeled with both isotopes. The ratio of ^{3}H/^{14}C incorporated in vivo was lowest in catalase of microsomes and ribosomes, highest in that of peroxisomes, and intermediate in catalase of the soluble fraction of liver cells. The former remained almost constant, while the latter two increased to a plateau after injection of the isotopic tracers. Results suggested that an intermediate is formed, which contains less heme than in the completed molecule. Further addition of heme to this intermediate seems to occur in the cytosol, and probably also in the peroxisomes. (auth)

6895 LIVER SCINTIGRAPHY WITH ^{99m}Tc-Sn-COLLOID AND ^{99m}Tc-PHYTATE. Comparison with ^{198}Au-colloid and ^{99m}Tc-sulfur Colloid. Aburano, T.; Ueno, K.; Watanabe, H.; Hisada, K. (Kanazawa Univ. (Japan). School of Medicine). Kaku Igaku; 11: No. 6, 617-623(Dec 1974). (In Japanese).

Liver scintigraphy with ^{99m}Tc-Sn-colloid or ^{99m}Tc-phytate was done in over 200 cases. In the present study, the comparison between each of these two ^{99m}Tc-compounds and ^{99m}Tc-sulfur colloid or ^{198}Au-colloid was done clinically. Hepatic accumulation coefficient (K_1): hepatic accumulation curves were recorded in the same patient, using ^{99m}Tc-sulfur colloid, ^{99m}Tc-Sn-colloid and ^{99m}Tc-phytate. The result of these three hepatic accumulation coefficients (K_1) calculated from the curves showed that a) the value of ^{99m}Tc-Sn-colloid was about the same as that of ^{99m}Tc-sulfur colloid, and b) the value of ^{99m}Tc-phytate was the smallest among these three compounds. Degree of extrahepatic activity (especially, splenic visualization degree): it is very useful for the evaluation of diffuse hepatic disease to decide the abnormal splenic visualization degree. For the purpose, the comparison of splenic visualization degree was done on anterior view between ^{198}Au-colloid and each of these two compounds. The following findings were considered to be abnormal: a) a splenic activity was equal to or exceeded the hepatic activity in ^{99m}Tc-Sn-colloid scan; b) the splenic activity was obviously found in ^{99m}Tc-phytate scan, since in such cases the splenic activity was usually found in ^{198}Au-colloid scan. The order of splenic visualization degree among these three ^{99m}Tc-compounds was considered as follows: ^{99m}Tc-sulfur-colloid > ^{99m}Tc-Sn-colloid > ^{99m}Tc-phytate. Both ^{99m}Tc-Sn-colloid and ^{99m}Tc-phytate were considered to be superior to ^{198}Au-colloid and ^{99m}Tc-sulfur colloid, because of sharper scintigram with less radiation dose than ^{198}Au-colloid and more rapid and easier preparation than ^{99m}Tc-sulfur colloid, and these two ^{99m}Tc-compounds could be fully applicable into liver scintigraphy for the evaluation of diffuse as well as focal hepatic diseases. Moreover, although the particle size of these two compounds could not be evaluated accurately, it was inferred that a) the particle size of ^{99m}Tc-Sn-colloid was about the same as or a little smaller than that of ^{99m}Tc-sulfur colloid, and b) the particle size of ^{99m}Tc-phytate in the body was about the same as that of ^{198}Au-colloid. (auth)

6896 A NEW METHOD FOR MEASUREMENT OF RIGHT VENTRICULAR RESIDUAL RATIO USING ^{131}I-MAA. Kanemoto, N.; Tomoda, H.; Handa, S.; Kunieda, T.; Ogino, T. (Keio Univ., Tokyo (Japan). School of Medicine). Jap. Heart J.; 15: No. 6, 543-553(Nov 1974).

A new technique of precordial counting with ^{131}I-MAA for measurement of right ventricular residual ratio (RVRR) was described. The ^{131}I-MAA was rapidly injected into the right ventricle at the time of right heart catheterization. The fraction of isotope discharged from this chamber per beat was determined with a crystal detector with tapered collimator which was pointed to the center of right ventricle. The radioisotope dilution curve was corrected by using the lung build-up curve recorded by the other detector pointed to the lung field. Then, the right ventricular end-systolic volume (ESV) and the right ventricular end-diastolic volume (EDV) were calculated from the RVRR and stroke volume. In six patients with normal hemodynamics, the RVRR averaged 57.8 ± 4.9%, the ESV 52.2 ± 13.6 ml/M^2, and the EDV 89.4 ± 15.1 ml/M^2. In 16 patients with heart diseases, the RVRR averaged 60.6 ± 7.1%, the ESV 80.6 ± 34.0 ml/M^2, and the EDV 127.2 ± 43.6 ml/M^2. In 11 patients with chronic pulmonary diseases, the RVRR averaged 70.7 ± 9.9%, the ESV 94.7 ± 42.4 ml/M^2, and the EDV 133.0 ± 46.5 ml/M^2. The RVRR in the last group increased significantly. (auth)

6897 EVALUATION OF GAMMA-CAMERA RENOGRAM BY ^{99m}Tc-(Sn)DTPA. On the Differentiation of Obstructive and Parenchymal Renal Diseases. Ohishi, Y.; Chiba, K.; Matsui, K.; Yamada, H.; Irikura, H. (Tokyo Metropolitan Geriatric Medical Center (Japan)). Kaku Igaku; 11: No. 5, 541-552(Oct 1974). (In Japanese).

Two mCi of ^{99m}Tc-(Sn)DTPA and 300 μCi of ^{131}I-Hippuran were applied successively on 105 cases to evaluate their values for the γ-camera renograms. Cases were composed of 53 males and 52 females ranging from 17 to 97 y.o. (mean 60 y.o.). Nuclear Chicago Pho/Gamma HP was used and data are stored in the data store playback system. After the storing of about 20 min. renograms and renal images, regions of interest were set for the kidneys and γ-camera renograms were obtained. In general both renograms revealed good correlation though better images could be obtained by ^{99m}Tc-(Sn)DTPA. However, ^{99m}Tc-(Sn)DTPA was more sensitive to detect the abnormality in such cases as mild hydronephrosis or operated hydronephrosis that showed recovered renograms by ^{131}I-Hippuran. Also ^{131}I-Hippuran renogram shows occasionally obstructive pattern in cases with advanced parenchymal renal disease causing difficulty in differentiating parenchymal renal diseases from obstructive disorders. However ^{99m}Tc-(Sn)DTPA renogram showed a clear-cut difference between these two disorders. Addition of renal images created further aids for the differential diagnosis. In conclusion, γ-camera renograms by ^{99m}Tc-(Sn)DTPA combined with ^{131}I-Hippuran renogram were found to be useful for differential diagnosis of obstructive, parenchymal, and ischemic renal disorders. These methods, with their non-traumatic nature, are also quite useful for the diagnosis of renal disorders in cases with poor risk and in aged cases. (auth)

6898 STUDIES ON THE DISTRIBUTION OF ANTITUMOR AMINO ACID RELATED COMPOUNDS BY WHOLE BODY AUTORADIOGRAPHY IN MICE. Naganuma, M.; Fukushima, K.; Toyoshima, S. (Keio Univ., Tokyo (Japan). School of Medicine). Nippon Yakurigaku Zasshi; 70: No. 6, 849-861(Nov 1974). (In Japanese).

Four novel antitumor amino acid related compounds were labeled with ^{14}C and the distribution was studied in mice. N-naphthalenesulphonyl-DL-tryptophan(A-91) was excreted into the bile, and a high level of radioactivity in the blood was maintained throughout the 24 hr of the experiment. A high radioactivity was seen in the liver, lung, kidney, urinary bladder, and tumor. N-ethylcarbaminomethyl-L-isoleucine(A-145) was rapidly distributed to each tissue from the blood, especially to the pancreas, salivary glands, gastrointestinal tract, tumor, and other growing and secreting tissue. N-fluoreneacetyl-L-phenylalanine(A-192) was excreted into the bile and a high level of radioactivity was seen in the blood. A high radioactivity was detected in the liver, lung, kidney, uterus, ovary, and tumor, followed by a reduction paralleled with a concentration in the blood. A-192 was rapidly excreted into the urine and very little radioactivity was observed in almost all organs and tissues, except for the central nervous system. Cyclophosphamide was also rapidly excreted into the urine and bile, but only slight activity was observed in most organs. Tryptophan, isoleucine, and valine had the same distribution patterns, and were incorporated into the growing and secreting tissues, pancreas, salivary glands, gastrointestinal tract, and tumor. (auth)

6899 RADIOIMMUNOASSAY OF UNCONJUGATED OESTRADIOL IN URINE. Kono, S.; Loriaux, D. L.; Lipsett, M. B. (National Institutes of Health, Bethesda, MD). Acta Endocrinol.; 76: No. 4, 741-746(Aug 1974).

A radioimmunoassay was developed for measurement of unconjugated oestradiol in urine. After extracting with ether and purifying by thin-layer chromatography, the assay is performed using anti-serum prepared against oestrone-17-oxime-bovine serum albumin conjugate. Dextran-coated charcoal is used to separate free and bound fractions. The measurable range on the standard curve is from 10 to 1000 pg. The blank of the method is 9.7 ± 3.6 pg (SD) and is independent of urine volume. The intra-assay coefficient of variation is 9.5% and the inter-assay variation is 12.8%. The accuracy and specificity of the method are also satisfactory. During one menstrual cycle, urinary free oestradiol averaged 32 ng/day (n = 9, range 22 to 58) during the follicular phase; 341 ng/day at the mid-cycle peak; and 46 ng/day (n = 10, range 12 to 138) during the luteal phase. The oestradiol content of 3 consecutive 24-h urines from a normal man was 4.8 ng/day (2.7 to 7.2). (auth)

6900 CIRCULATING IMMUNE COMPLEXES IN THE SERUM IN SYSTEMIC LUPUS ERYTHEMATOSUS AND IN CARRIERS OF HEPATITIS B ANTIGEN: QUANTITATION BY BINDING TO RADIOLABELED Clq. Nydegger, U. E.; Lambert, P. H.; Gerber, H.; Miescher, P. A. (Univ. of Geneva). J. Clin. Invest.; 54: No. 2, 297-309(Aug 1974).

A sensitive and reproducible procedure for the detection of soluble immune complexes in sera from patients with various immunopathological disorders is reported. Radiolabeled Clq is reacted with sera containing immune complexes. Separation of

free from complex bound [^{125}I]Clq is achieved by selective precipitation with polyethylene glycol (PEG). The method is based on both the large molecular size and the Clq-binding property characterizing immune complexes. The minimal amount of aggregated immunoglobulins thus detected is about 10 mu g and that of soluble human IgG-anti-IgG complexes is about 3 mu g of complexed antibody. Some immune complexes formed in large antigen excess (Ag_2Ab) can still be detected by this radiolabeled Clq binding assay. The specificity of the radiolabeled Clq binding test was documented by the inability of antigen-$F(ab')_2$ antibody complexes to lead to a precipitation of [^{125}I]Clq in PEG. In a second step, this radiolabeled Clq binding assay was applied to an experimental model of immune complex disease and was shown to be efficient for the detection of in vivo formed immune complexes. Finally, the technique could be applied to the study of sera from patients with systemic lupus erythematosus (SLE) or to carriers of the hepatitis B antigen (HB-Ag). Significantly increased [^{125}I]-Clq binding values were observed in 52 sera from SLE patients when compared to values obtained with healthy blood donors (P less than 0.001). Particularly high values were seen in active disease, a finding which was confirmed by follow-up studies performed with four SLE patients. No increased [^{125}I]Clq binding was seen in 18 healthy carriers of the HB-Ag; whereas, sera from carriers with hepatitis appear to precipitate increased [^{125}I]Clq percentages: 7/24 cases with acute transient and 4/7 cases with chronic persistent hepatitis were found to increasingly bind [^{125}I]Clq. The results were also used for a correlative study of [^{125}I]Clq binding to IgG levels in the sera but increased [^{125}I]Clq binding could not be attributed to high serum IgG levels which are likely to account for gammaglobulin aggregates. These examples suggest the utility of the radiolabeled Clq binding assay for the evaluation of immune complex diseases in human pathology. (auth)

6901 IN VIVO ASSESSMENT OF LIVER SIZE IN THE RAT. Leach, K. G.; Karran, S. J.; Wisbey, M. L.; Blumgart, L. H. (Univ. Hospital of Wales, Cardiff). J. Nucl. Med.; 16: No. 5, 380-385(May 1975).

In vivo assessment of liver mass in the rat was achieved using several parameters obtained by scintigraphy, including one computed using a Nuclear Data 50:50 analysis system. All correlated well with the directly measured liver weight. The simplest parameter, the area of the anterior view measured from the Polaroid scintigraph, was therefore the one preferred. The results so obtained were compared with those derived from the relationship between liver and body weights. It is suggested that this accurate in vivo measurement of liver mass is of value in the study of the pathophysiology of this organ. (auth)

6902 INTEGRATION OF PULSATILE GONADOTROPIN SECRETION BY TIMED URINARY MEASUREMENTS: AN ACCURATE AND SENSITIVE 3-HOUR TEST. Kulin, H. E.; Bell, P. M.; Santen, R. J.; Ferber, A. J. (Pennsylvania State Univ., Hershey). J. Clin. Endocrinol. Metab.; 40: No. 5, 783-789(May 1975).

The integration of pulsatile gonadotropin secretion by the radioimmunoassay of an acetone precipitation from a short-term urine sample was evaluated. FSH and LH excretion over a 3-h period was compared to the mean level of 10 blood samples obtained every 20 min for a similar time period from 71 patients. A highly significant correlation existed between blood and urine results. In addition, the gonadotropin levels obtained from a 3-h sample correlated well with the 24-h excretion of FSH and LH from the same individual. A 3-h urine collection can provide a simple, sensitive, and accurate means of assessing circulating FSH and LH levels. (auth)

6903 24-HOUR SECRETORY PATTERN OF DEHYDROISOANDROSTERONE AND DEHYDROISOANDROSTERONE SULFATE. Rosenfeld, R. S.; Rosenberg, B. J.; Fukushima, D. K.; Hellman, L. (Montefiore Hospital and Medical Center, New York). J. Clin. Endocrinol. Metab.; 40: No. 5, 850-855(May 1975).

Dehydroisoandrosterone (DHA) and cortisol were measured by radioimmunoassay and protein binding techniques respectively in plasma from blood taken at 20-min intervals over 24-h periods in 3 normal men, 2 women with Stein-Leventhal syndrome, and a man with a benign adrenocortical adenoma. In all subjects but the latter, DHA and cortisol were episodic and synchronous throughout the entire day; in this patient, continuous secretion of cortisol by the tumor apparently abolished stimulation of the contralateral adrenal, and DHA production was negligible. Dehydroisoandrosterone sulfate analyses in plasma displayed a pattern which, probably because of its origin both by secretion and sulfation and its long half-life, showed less synchronicity with DHA and cortisol and less fluctuation than did the free hormones. (auth)

6904 NONCHROMATOGRAPHIC RADIOIMMUNOASSAY FOR 17 ALPHA-HYDROXYPROGESTERONE. Hami, M.; Rosler, A.; Rabinowitz, D. (Hadassah Univ. Hospital, Jerusalem). J. Clin. Endocrinol. Metab.; 40: No. 5, 863-867(May 1975).

A radioimmunoassay is described for the measurement of 17alpha-hydroxyprogesterone in human plasma. We have employed the principle of immunologic purification. 17-OHP and related steroids are bound to an excess of antiserum. Steroids with a low affinity for the antibody are extracted by ether. The 17-OHP is subsequently freed from antibody by acid hydrolysis and this extract is assayed by radioimmunoassay. (auth)

6905 SIMPLE SPECIFIC ASSAY FOR ESTRIOL IN MATERNAL URINE. Davis, S. E.; Loriaux, D. L. (Medical Coll. of Virginia, Richmond). J. Clin. Endocrinol Metab.; 40: No. 5, 895-900(May 1975).

In medical centers with many high risk pregnancies, the ability to perform a large number of urinary estriol measurements is required. The analytical procedure should provide simplicity, specificity, and economy. A solid phase radioimmunoassay is presented which utilizes antibody generated against an estriol 16-glucuronide-bovine serum albumin conjugate. The assay allows analysis of the principal component of maternal urinary estriol without hydrolysis or purification, with adequate specificity and the capacity for processing large numbers of samples. (auth)

6906 APPLICATION OF IMAGE INTENSIFIER FOR AUTORADIOGRAPHY OF POLYACRILAMIDE GELS. Brisgunov, V.; Rebentish, B.; Gordon, I.; Debabov, V. (Inst. of Atomic Energy, Moscow). Anal. Biochem.; 66: No. 1, 100-103(26 May 1975).

A technique for autoradiography of polyacrilamide gels is described, which utilizes an image intensifier. The modified procedure reduces the exposure periods by a factor of approximately 10^3-fold. The special advantage of the method is that it can be applied to wet gels, which eliminates the procedure of gel drying. (auth)

6907 ABNORMAL RADIONUCLIDE DEPOSITION PATTERNS ADJACENT TO FOCAL SKELETAL LESIONS. Thrall, J. H.; Geslien, G. E.; Corcoron, R. J.; Johnson, M. C. (Walter Reed Army Medical Center, Washington, DC). Radiology; 115: No. 5, 659-663(Jun 1975).

A scintigraphic pattern is described for bone scans with /sup 99m/Tc-polyphosphate and /sup 99m/Tc-diphosphonate in which abnormal tracer accumulation extends beyond the known limits of certain skeletal lesions. The associated pathologic entities include benign and malignant tumors, infection, and trauma. The pathogenesis of "extended patterns" has not been proved but probably relates to regional hyperemia induced by associated lesions. Increased blood flow results in more tracer delivery to otherwise normal bone in the "watershed" areas of hyperemia, producing these patterns. (auth)

6908 DETECTION OF CRANIOSYNOSTOSIS BY BONE SCANNING. Gates, G. F.; Dore, E. K. (Stanford Medical Center, CA). Radiology; 115: No. 5, 665-671(Jun 1975).

Growth patterns of the cranial sutures were studied by bone scanning in 29 children, 13 of whom had craniosynostosis. Primary craniosynostosis was initiated by localized bony fusion across a suture, associated with an abnormal accumulation of bone-seeking radiopharmaceuticals. As the abnormal fusion process extended along the suture, there was a corresponding spread of radionuclide. With complete fusion, uptake diminished. In addition to calvarial scanning, three abnormal sutures were scanned following surgical excision, which allowed direct comparison in vivo and in vitro. Calvarial bone scanning is helpful in the early detection of primary craniosynostosis. (auth)

6909 DECOMPRESSION HYPEROSTOSIS: CRANIAL HYPEROSTOSIS MIMICKING BILATERAL SUBDURAL HEMATOMA ON BRAIN SCINTIGRAPHY. Hattner, R. S.; Putman, C.; Shames, D. M. (Univ. of California Medical School, San Francisco). Radiology; 115: No. 5, 673-674(Jun 1975).

Scintigraphic findings suggestive of bilateral subdural hematoma developed after successful decompression of communicating hydrocephalus. These findings were secondary to cranial hyperostosis. The similarity of brain scintigraphic findings in the two disorders is pointed out, and the necessity of correlating brain scintigraphs with skull radiographs is stressed. (auth)

6910 SCINTIGRAPHIC FINDINGS IN PRIMARY AMYLOIDOSIS. Sostre, S.; Martin, N. D.; Lucas, R. N.; Strauss, H. W. (Johns Hopkins Medical Inst., Baltimore). Radiology; 115: No. 5, 675-677(Jun 1975).

Images of 7 patients with primary amyloidosis revealed organomegaly with regions of decreased tracer accumulation due to infiltration and replacement of normal tissue by the amyloid complex. These scintigraphic changes in the clinical setting of multisystem disease should suggest amyloidosis as a possible diagnosis. (auth)

6911 ^{131}I ROSE BENGAL LIVER SCANNING IN THE DIFFERENTIAL DIAGNOSIS OF NEONATAL JAUNDICE. Wicksman, R. S.; Adcock, D. F.; Bream, C. A.; Scatliff, J. H. (Univ. of

North Carolina School of Medicine, Chapel Hill). South. Med. J.; 68: No. 5, 599-602(May 1975).

Results of a series of 22 liver scans with ^{131}I rose bengal in 21 patients who developed progressive jaundice in the neonatal period are described. Using the ^{131}I rose bengal scan alone, an attempt was made to separate the patients into two groups, the first with total bile obstruction (biliary atresia) and the second with only partial biliary tract obstruction (intrinsic liver disease). The diagnostic accuracy of the scan was 82 percent. An additional diagnostic criterion, the count ratio, is suggested. The determination of this ratio requires no additional effort or expense and would improve the diagnostic accuracy of the scan used alone in this series of patients. (auth)

6912 SEASONAL PATTERN OF PHOTOSYNTHESIS IN INDIVIDUAL GRASS LEAVES AND OTHER PLANT PARTS IN ARCTIC ALASKA WITH A PORTABLE $^{14}CO_2$ SYSTEM. Tieszen, L. L.; Johnson, D. A. (Augustana Coll., Sioux Falls, SD). Bot. Gaz. (Chicago).; 136: No. 1, 99-105(Mar 1975).

A portable system for photosynthesis determinations has been used under field conditions in the Arctic at Barrow, Alaska. Maximum photosynthetic rates were greater than 18 mg CO_2. $dm^{-2}.h^{-1}$ in a number of species and were comparable with those of other C_3 plants in arctic and temperate areas. Rates were closely coupled to irradiance. Plant components other than expanded blades were active in CO_2 uptake. In Dupontia fischeri, leaf sheaths and culms possessed rates greater than 50 percent of those of mature leaves. The leaves of D. fischeri and Alopecurus alpinus are produced sequentially and possess distinct seasonal patterns which appear related to leaf growth, maturation, and senescence stages. Thus, even in the short growing season of the Arctic, these grasses possess sequential patterns of leaf development and photosynthesis rather than a synchronized early season burst of leaf production. (auth)

6913 SELECTIVE ARTERIOSCANNOGRAPHY OF THE INTESTINE IN THE DIAGNOSIS OF MALIGNANT TUMORS. Efleev, V. P. (Scientific-Research Inst. of Rapid Service, Moscow). Med. Radiol.; 20: No. 5, 12-15(May 1975). (In Russian).

The article deals with the new method of diagnosis based on the carrying out of mesentericography with a successive introduction of ^{131}I-MAA in the arterial canal of the intestine and subsequent scanning of the intestine. The data on arterioscannography of the intestine in 17 patients with malignant tumors is the basis of the given report. The investigation methods were described. As a result of the carried out work a new way of scannographical visualization of the intestinal wall was proposed and it was noted that information obtained with the use of mesentericography and arterioscannography did not contradict but mutually complement each other. The condition of the intestine was better revealed on the arterioscannogram. The authenticity of arterioscannography was checked during the operation by the data and results of histological investigation. Complex information obtained as a result of arterioscanning of the intestine can play a definite role in early diagnosis of malignant tumors of the intestine and help solve more rationally the problem of medical tactics. (auth)

6914 DETERMINATION OF THE AMOUNT OF TOTAL Fe BY THE METHOD OF THE WHOLE-BODY RADIOMETRY. Bolovin, L. M.; Gabuniya, R. I.; Kaplan, M. A. (Scientific-Research Inst. of Medical Radiology, Obninsk, USSR). Med. Radiol.; 20: No. 5, 15-17(May 1975). (In Russian).

A technique for determination of total metabolic Fe in man with the aid of ^{59}Fe using radiometry of the whole body is described. The amount of Fe determined by this method in 32 patients was 3.4 ± 0.2 g including 2.3 ± 0.1 g of hemoglobin Fe. The analysis of the content of total reserves of Fe in the organism depending upon sex showed that it was 3.9 ± 0.3 g in men and 2.4 ± 0.1 in women. The amount of hemoglobin Fe in men was 2.4 ± 0.1 g and in women 2.0–1.0 g. The amount of Fe in reserve was 1.5 ± 0.2 g in men and 0.3 ± 0.1 g in women. Determination of total metabolic Fe after intravenous administration to 10 patients demonstrated that as an average its amount was 2.5 ± 0.1 g including 2.4–0.3 of hemoglobin Fe. (auth)

6915 ASSIMILATION OF LABELED IRON (^{59}Fe) IN THE NORMAL MAN AND IN SOME DISEASES BY RADIOMETRY METHOD OF THE WHOLE BODY. Petrov, V. N.; Shapiro, E. L.; Ivanov, E. V. (Leningrad Medical Inst.). Med. Radiol.; 20: No. 5, 17-22(May 1975). (In Russian).

The authors present the results of assimilation of ^{59}Fe from the solution of ferric sulfate in citrateascorbinate medium, enriched inferric sulfate of bread and labeled hemoglobin in practically healthy persons, from the solution of ferric sulfate in citrateascorbinate medium–in patients with peptic ulcer and chronic glomerulonephritis. A total of 199 patients were under observation. The authors showed the dependence of iron absorption upon the indices of iron metabolism and its reserves in the bone marrow in practically healthy persons. In patients suffering from peptic ulcer, assimilation of iron increased with accompanying deficiency of iron and in chronic glomerulonephritis it depended upon the indices of nitrous metabolism. Differences of assimilation from different types of iron were observed. (auth)

6916 STUDY OF ^{14}C PENETRATION INTO FILTERS IN PRIMARY PRODUCTIVITY MEASUREMENTS USING DOUBLE SIDE COUNTING. Theodorsson, P. (Univ. of Iceland, Reykjavik). Limnol. Oceanogr.; 20: No. 2, 288-291(Mar 1975).

The ^{14}C-labeled assimilated organic matter penetrates into filters when primary productivity is measured but does not lie in a thin layer on the surface as has been assumed. This has been demonstrated by counting the filters from both sides with a Geiger-Mueller counter and confirmed by measuring the counting efficiency of individual filters. When the double side counting indicates deeper penetration, the Geiger-Mueller efficiency decreases as expected. (auth)

6917 PREPARATION OF A HIGHLY PURIFIED ANTIBODY AND A SOLID-STATE IMMUNOASSAY FOR PORCINE PANCREATIC alpha-AMYLASE. Wedner, H. J.; Parker, L. N.; Rosenfeld, M. G. (Washington Univ., St. Louis). Anal. Biochem.; 65: No. 1-2, 175-186(12 May 1975).

Porcine pancreas and parotid cell suspensions provide model systems in which to study the mechanism of induction of a specific protein, alpha-amylase, by hormones acting via cAMP. A highly purified antibody against porcine pancreatic alpha-amylase was prepared using affinity chromatography of the total IgG fraction derived from rabbit anti-alpha-amylase antiserum and was used to develop a radioimmunoassay for alpha-amylase. The antigen–antibody complex was separated from unbound alpha-amylase using either glutaraldehyde gelled alpha-amylase or a second antibody technique; a linear standard curve was achieved over a 100- to 1000-fold range of alpha-amylase concentration. Tissue homogenates did not interfere with this assay, and assayed levels of alpha-amylase in porcine pancreas were linear using 10 to 200 mu g of homogenate. No levels or very low levels of alpha-amylase were detected in control tissues. (auth)

6918 CONTINUOUS FLOW AUTOMATED RADIOIMMUNOASSAY USING ANTIBODIES ATTACHED TO RED BLOOD CELLS. Luner, S. J. (Univ. of California, Los Angeles). Anal. Biochem.; 65: No. 1-2, 355-361(12 May 1975).

Continuous-flow automated radioimmunoassays can be performed using antibodies which have been attached to red blood cells with chromic chloride. To separate the antibody-bound labeled antigen from unbound labeled antigen the erythrocytes are aggregated by Polybrene and separated from the supernatant by decantation. For the determination of serum insulin levels the method was sensitive to within 2 mu U/ml when operating at a sampling rate of 10/hr with a total assay time of 1½ hr. (auth)

6919 NEW AND HIGHLY SENSITIVE ASSAY FOR THE ATP PHOSPHORIBOSYLTRANSFERASE THAT CATALYZES THE FIRST STEP OF HISTIDINE BIOSYNTHESIS. Kronenberg, H. M.; Vogel, T.; Goldberger, R. F. (National Cancer Inst., Bethesda, MD). Anal. Biochem.; 65: No. 1-2, 380-388(12 May 1975).

A new method is described for assaying the ATP phosphoribosyltransferase (EC 2.4.2.17) that catalyzes the first step of histidine biosynthesis in bacterial cells. This is a highly sensitive radioassay, capable of detecting fewer than 10^3 molecules of enzyme. In contrast to the previously available assay, it can be carried out in the presence of other molecules that absorb uv light. The assay may find useful application in studies on the in vitro synthesis of the enzymes for histidine biosynthesis and in studies on the various aggregation states of the enzyme. (auth)

6920 RAPID ASSAY METHOD FOR HYALURONIDASE. Coulson, C. J.; Girkin, R. (May and Baker Ltd., Dagenham, Eng.). Anal. Biochem.; 65: No. 1-2, 427-434(12 May 1975).

Hyaluronidase activity has been measured by a semimicro radiochemical method. ^3H-Hyaluronic acid was prepared using hydrazine to remove some of the acetyl groups followed by reacetylation with tritiated acetic anhydride. Hydrolysis was carried out using an extract from rat liver lysosomes and a cruder extract from other tissues. At the completion of hydrolysis, cetylpyridinium chloride was added to precipitate unreacted substrate. Smaller molecular-weight oligosaccharides produced by hydrolysis remain in solution to be determined by liquid scintillation counting. This assay gives results that are similar to those obtained by the assay using N-acetylglucosamine end-group determination but, in the case of tissue extracts, in 1 hr instead of 18 hr. (auth)

6921 MEASUREMENT OF GLUTAMATE DECARBOXYLASE ACTIVITY IN BRAIN TISSUES BY A SIMPLE MICRORADIOMETRIC METHOD. Moskal, J. R.; Basu, S. (Univ. of Notre Dame, IN). Anal. Biochem.; 65: No. 1-2, 449-457(12 May 1975).

A simple method was developed for the assay of L-glutamate decarboxylase (GAD) in brain homogenate and subcellular frac-

free from complex bound [^{125}I]Clq is achieved by selective precipitation with polyethylene glycol (PEG). The method is based on both the large molecular size and the Clq-binding property characterizing immune complexes. The minimal amount of aggregated immunoglobulins thus detected is about 10 mu g and that of soluble human IgG-anti-IgG complexes is about 3 mu g of complexed antibody. Some immune complexes formed in large antigen excess (Ag_2Ab) can still be detected by this radiolabeled Clq binding assay. The specificity of the radiolabeled Clq binding test was documented by the inability of antigen-$F(ab')_2$ antibody complexes to lead to a precipitation of [^{125}I]Clq in PEG. In a second step, this radiolabeled Clq binding assay was applied to an experimental model of immune complex disease and was shown to be efficient for the detection of in vivo formed immune complexes. Finally, the technique could be applied to the study of sera from patients with systemic lupus erythematosus (SLE) or to carriers of the hepatitis B antigen (HB-Ag). Significantly increased [^{125}I]-Clq binding values were observed in 52 sera from SLE patients when compared to values obtained with healthy blood donors (P less than 0.001). Particularly high values were seen in active disease, a finding which was confirmed by follow-up studies performed with four SLE patients. No increased [^{125}I]Clq binding was seen in 18 healthy carriers of the HB-Ag; whereas, sera from carriers with hepatitis appear to precipitate increased [^{125}I]Clq percentages: 7/24 cases with acute transient and 4/7 cases with chronic persistent hepatitis were found to increasingly bind [^{125}I]Clq. The results were also used for a correlative study of [^{125}I]Clq binding to IgG levels in the sera but increased [^{125}I]Clq binding could not be attributed to high serum IgG levels which are likely to account for gammaglobulin aggregates. These examples suggest the utility of the radiolabeled Clq binding assay for the evaluation of immune complex diseases in human pathology. (auth)

6901 IN VIVO ASSESSMENT OF LIVER SIZE IN THE RAT. Leach, K. G.; Karran, S. J.; Wisbey, M. L.; Blumgart, L. H. (Univ. Hospital of Wales, Cardiff). J. Nucl. Med.; 16: No. 5, 380-385(May 1975).

In vivo assessment of liver mass in the rat was achieved using several parameters obtained by scintigraphy, including one computed using a Nuclear Data 50:50 analysis system. All correlated well with the directly measured liver weight. The simplest parameter, the area of the anterior view measured from the Polaroid scintigraph, was therefore the one preferred. The results so obtained were compared with those derived from the relationship between liver and body weights. It is suggested that this accurate in vivo measurement of liver mass is of value in the study of the pathophysiology of this organ. (auth)

6902 INTEGRATION OF PULSATILE GONADOTROPIN SECRETION BY TIMED URINARY MEASUREMENTS: AN ACCURATE AND SENSITIVE 3-HOUR TEST. Kulin, H. E.; Bell, P. M.; Santen, R. J.; Ferber, A. J. (Pennsylvania State Univ., Hershey). J. Clin. Endocrinol. Metab.; 40: No. 5, 783-789(May 1975).

The integration of pulsatile gonadotropin secretion by the radioimmunoassay of an acetone precipitation from a short-term urine sample was evaluated. FSH and LH excretion over a 3-h period was compared to the mean level of 10 blood samples obtained every 20 min for a similar time period from 71 patients. A highly significant correlation existed between blood and urine results. In addition, the gonadotropin levels obtained from a 3-h sample correlated well with the 24-h excretion of FSH and LH from the same individual. A 3-h urine collection can provide a simple, sensitive, and accurate means of assessing circulating FSH and LH levels. (auth)

6903 24-HOUR SECRETORY PATTERN OF DEHYDROISOANDROSTERONE AND DEHYDROISOANDROSTERONE SULFATE. Rosenfeld, R. S.; Rosenberg, B. J.; Fukushima, D. K.; Hellman, L. (Montefiore Hospital and Medical Center, New York). J. Clin. Endocrinol. Metab.; 40: No. 5, 850-855(May 1975).

Dehydroisoandrosterone (DHA) and cortisol were measured by radioimmunoassay and protein binding techniques respectively in plasma from blood taken at 20-min intervals over 24-h periods in 3 normal men, 2 women with Stein-Leventhal syndrome, and a man with a benign adrenocortical adenoma. In all subjects but the latter, DHA and cortisol were episodic and synchronous throughout the entire day; in this patient, continuous secretion of cortisol by the tumor apparently abolished stimulation of the contralateral adrenal, and DHA production was negligible. Dehydroisoandrosterone sulfate analyses in plasma displayed a pattern which, probably because of its origin both by secretion and sulfation and its long half-life, showed less synchronicity with DHA and cortisol and less fluctuation than did the free hormones. (auth)

6904 NONCHROMATOGRAPHIC RADIOIMMUNOASSAY FOR 17 ALPHA-HYDROXYPROGESTERONE. Hami, M.; Rosler, A.; Rabinowitz, D. (Hadassah Univ. Hospital, Jerusalem). J. Clin. Endocrinol. Metab.; 40: No. 5, 863-867(May 1975).

A radioimmunoassay is described for the measurement of 17alpha-hydroxyprogesterone in human plasma. We have employed the principle of immunologic purification. 17-OHP and related steroids are bound to an excess of antiserum. Steroids with a low affinity for the antibody are extracted by ether. The 17-OHP is subsequently freed from antibody by acid hydrolysis and this extract is assayed by radioimmunoassay. (auth)

6905 SIMPLE SPECIFIC ASSAY FOR ESTRIOL IN MATERNAL URINE. Davis, S. E.; Loriaux, D. L. (Medical Coll. of Virginia, Richmond). J. Clin. Endocrinol Metab.; 40: No. 5, 895-900(May 1975).

In medical centers with many high risk pregnancies, the ability to perform a large number of urinary estriol measurements is required. The analytical procedure should provide simplicity, specificity, and economy. A solid phase radioimmunoassay is presented which utilizes antibody generated against an estriol 16-glucuronide-bovine serum albumin conjugate. The assay allows analysis of the principal component of maternal urinary estriol without hydrolysis or purification, with adequate specificity and the capacity for processing large numbers of samples. (auth)

6906 APPLICATION OF IMAGE INTENSIFIER FOR AUTORADIOGRAPHY OF POLYACRILAMIDE GELS. Brisgunov, V.; Rebentish, B.; Gordon, I.; Debabov, V. (Inst. of Atomic Energy, Moscow). Anal. Biochem.; 66: No. 1, 100-103(26 May 1975).

A technique for autoradiography of polyacrilamide gels is described, which utilizes an image intensifier. The modified procedure reduces the exposure periods by a factor of approximately 10^3-fold. The special advantage of the method is that it can be applied to wet gels, which eliminates the procedure of gel drying. (auth)

6907 ABNORMAL RADIONUCLIDE DEPOSITION PATTERNS ADJACENT TO FOCAL SKELETAL LESIONS. Thrall, J. H.; Geslien, G. E.; Corcoron, R. J.; Johnson, M. C. (Walter Reed Army Medical Center, Washington, DC). Radiology; 115: No. 5, 659-663(Jun 1975).

A scintigraphic pattern is described for bone scans with /sup 99m/Tc-polyphosphate and /sup 99m/Tc-diphosphonate in which abnormal tracer accumulation extends beyond the known limits of certain skeletal lesions. The associated pathologic entities include benign and malignant tumors, infection, and trauma. The pathogenesis of "extended patterns" has not been proved but probably relates to regional hyperemia induced by associated lesions. Increased blood flow results in more tracer delivery to otherwise normal bone in the "watershed" areas of hyperemia, producing these patterns. (auth)

6908 DETECTION OF CRANIOSYNOSTOSIS BY BONE SCANNING. Gates, G. F.; Dore, E. K. (Stanford Medical Center, CA). Radiology; 115: No. 5, 665-671(Jun 1975).

Growth patterns of the cranial sutures were studied by bone scanning in 29 children, 13 of whom had craniosynostosis. Primary craniosynostosis was initiated by localized bony fusion across a suture, associated with an abnormal accumulation of bone-seeking radiopharmaceuticals. As the abnormal fusion process extended along the suture, there was a corresponding spread of radionuclide. With complete fusion, uptake diminished. In addition to calvarial scanning, three abnormal sutures were scanned following surgical excision, which allowed direct comparison in vivo and in vitro. Calvarial bone scanning is helpful in the early detection of primary craniosynostosis. (auth)

6909 DECOMPRESSION HYPEROSTOSIS: CRANIAL HYPEROSTOSIS MIMICKING BILATERAL SUBDURAL HEMATOMA ON BRAIN SCINTIGRAPHY. Hattner, R. S.; Putman, C.; Shames, D. M. (Univ. of California Medical School, San Francisco). Radiology; 115: No. 5, 673-674(Jun 1975).

Scintigraphic findings suggestive of bilateral subdural hematoma developed after successful decompression of communicating hydrocephalus. These findings were secondary to cranial hyperostosis. The similarity of brain scintigraphic findings in the two disorders is pointed out, and the necessity of correlating brain scintigraphs with skull radiographs is stressed. (auth)

6910 SCINTIGRAPHIC FINDINGS IN PRIMARY AMYLOIDOSIS. Sostre, S.; Martin, N. D.; Lucas, R. N.; Strauss, H. W. (Johns Hopkins Medical Inst., Baltimore). Radiology; 115: No. 5, 675-677(Jun 1975).

Images of 7 patients with primary amyloidosis revealed organomegaly with regions of decreased tracer accumulation due to infiltration and replacement of normal tissue by the amyloid complex. These scintigraphic changes in the clinical setting of multisystem disease should suggest amyloidosis as a possible diagnosis. (auth)

6911 ^{131}I ROSE BENGAL LIVER SCANNING IN THE DIFFERENTIAL DIAGNOSIS OF NEONATAL JAUNDICE. Wicksman, R. S.; Adcock, D. F.; Bream, C. A.; Scatliff, J. H. (Univ. of

North Carolina School of Medicine, Chapel Hill). South. Med. J.; 68: No. 5, 599-602(May 1975).

Results of a series of 22 liver scans with ^{131}I rose bengal in 21 patients who developed progressive jaundice in the neonatal period are described. Using the ^{131}I rose bengal scan alone, an attempt was made to separate the patients into two groups, the first with total bile obstruction (biliary atresia) and the second with only partial biliary tract obstruction (intrinsic liver disease). The diagnostic accuracy of the scan was 82 percent. An additional diagnostic criterion, the count ratio, is suggested. The determination of this ratio requires no additional effort or expense and would improve the diagnostic accuracy of the scan used alone in this series of patients. (auth)

6912 SEASONAL PATTERN OF PHOTOSYNTHESIS IN INDIVIDUAL GRASS LEAVES AND OTHER PLANT PARTS IN ARCTIC ALASKA WITH A PORTABLE $^{14}CO_2$ SYSTEM. Tieszen, L. L.; Johnson, D. A. (Augustana Coll., Sioux Falls, SD). Bot. Gaz. (Chicago).; 136: No. 1, 99-105(Mar 1975).

A portable system for photosynthesis determinations has been used under field conditions in the Arctic at Barrow, Alaska. Maximum photosynthetic rates were greater than 18 mg CO_2. $dm^{-2}.h^{-1}$ in a number of species and were comparable with those of other C_3 plants in arctic and temperate areas. Rates were closely coupled to irradiance. Plant components other than expanded blades were active in CO_2 uptake. In Dupontia fischeri, leaf sheaths and culms possessed rates greater than 50 percent of those of mature leaves. The leaves of D. fischeri and Alopecurus alpinus are produced sequentially and possess distinct seasonal patterns which appear related to leaf growth, maturation, and senescence stages. Thus, even in the short growing season of the Arctic, these grasses possess sequential patterns of leaf development and photosynthesis rather than a synchronized early season burst of leaf production. (auth)

6913 SELECTIVE ARTERIOSCANNOGRAPHY OF THE INTESTINE IN THE DIAGNOSIS OF MALIGNANT TUMORS. Efleev, V. P. (Scientific-Research Inst. of Rapid Service, Moscow). Med. Radiol.; 20: No. 5, 12-15(May 1975). (In Russian).

The article deals with the new method of diagnosis based on the carrying out of mesentericography with a successive introduction of ^{131}I-MAA in the arterial canal of the intestine and subsequent scanning of the intestine. The data on arterioscannography of the intestine in 17 patients with malignant tumors is the basis of the given report. The investigation methods were described. As a result of the carried out work a new way of scannographical visualization of the intestinal wall was proposed and it was noted that information obtained with the use of mesentericography and arterioscannography did not contradict but mutually complement each other. The condition of the intestine was better revealed on the arterioscannogram. The authenticity of arterioscannography was checked during the operation by the data and results of histological investigation. Complex information obtained as a result of arterioscanning of the intestine can play a definite role in early diagnosis of malignant tumors of the intestine and help solve more rationally the problem of medical tactics. (auth)

6914 DETERMINATION OF THE AMOUNT OF TOTAL Fe BY THE METHOD OF THE WHOLE-BODY RADIOMETRY. Bolovin, L. M.; Gabuniya, R. I.; Kaplan, M. A. (Scientific-Research Inst. of Medical Radiology, Obninsk, USSR). Med. Radiol.; 20: No. 5, 15-17(May 1975). (In Russian).

A technique for determination of total metabolic Fe in man with the aid of ^{59}Fe using radiometry of the whole body is described. The amount of Fe determined by this method in 32 patients was 3.4 ± 0.2 g including 2.3 ± 0.1 g of hemoglobin Fe. The analysis of the content of total reserves of Fe in the organism depending upon sex showed that it was 3.9 ± 0.3 g in men and 2.4 ± 0.1 in women. The amount of hemoglobin Fe in men was 2.4 ± 0.1 g and in women 2.0–1.0 g. The amount of Fe in reserve was 1.5 ± 0.2 g in men and 0.3 ± 0.1 g in women. Determination of total metabolic Fe after intravenous administration to 10 patients demonstrated that as an average its amount was 2.5 ± 0.1 g including 2.4–0.3 of hemoglobin Fe. (auth)

6915 ASSIMILATION OF LABELED IRON (^{59}Fe) IN THE NORMAL MAN AND IN SOME DISEASES BY RADIOMETRY METHOD OF THE WHOLE BODY. Petrov, V. N.; Shapiro, E. L.; Ivanov, E. V. (Leningrad Medical Inst.). Med. Radiol.; 20: No. 5, 17-22(May 1975). (In Russian).

The authors present the results of assimilation of ^{59}Fe from the solution of ferric sulfate in citrateascorbinate medium, enriched inferric sulfate of bread and labeled hemoglobin in practically healthy persons, from the solution of ferric sulfate in citrateascorbinate medium–in patients with peptic ulcer and chronic glomerulonephritis. A total of 199 patients were under observation. The authors showed the dependence of iron absorption upon the indices of iron metabolism and its reserves in the bone marrow in practically healthy persons. In patients suffering from peptic ulcer, assimilation of iron increased with accompanying deficiency of iron and in chronic glomerulonephritis it depended upon the indices of nitrous metabolism. Differences of assimilation from different types of iron were observed. (auth)

6916 STUDY OF ^{14}C PENETRATION INTO FILTERS IN PRIMARY PRODUCTIVITY MEASUREMENTS USING DOUBLE SIDE COUNTING. Theodorsson, P. (Univ. of Iceland, Reykjavik). Limnol. Oceanogr.; 20: No. 2, 288-291(Mar 1975).

The ^{14}C-labeled assimilated organic matter penetrates into filters when primary productivity is measured but does not lie in a thin layer on the surface as has been assumed. This has been demonstrated by counting the filters from both sides with a Geiger-Mueller counter and confirmed by measuring the counting efficiency of individual filters. When the double side counting indicates deeper penetration, the Geiger-Mueller efficiency decreases as expected. (auth)

6917 PREPARATION OF A HIGHLY PURIFIED ANTIBODY AND A SOLID-STATE IMMUNOASSAY FOR PORCINE PANCREATIC alpha-AMYLASE. Wedner, H. J.; Parker, L. N.; Rosenfeld, M. G. (Washington Univ., St. Louis). Anal. Biochem.; 65: No. 1-2, 175-186(12 May 1975).

Porcine pancreas and parotid cell suspensions provide model systems in which to study the mechanism of induction of a specific protein, alpha-amylase, by hormones acting via cAMP. A highly purified antibody against porcine pancreatic alpha-amylase was prepared using affinity chromatography of the total IgG fraction derived from rabbit anti-alpha-amylase antiserum and was used to develop a radioimmunoassay for alpha-amylase. The antigen–antibody complex was separated from unbound alpha-amylase using either glutaraldehyde gelled alpha-amylase or a second antibody technique; a linear standard curve was achieved over a 100- to 1000-fold range of alpha-amylase concentration. Tissue homogenates did not interfere with this assay, and assayed levels of alpha-amylase in porcine pancreas were linear using 10 to 200 mu g of homogenate. No levels or very low levels of alpha-amylase were detected in control tissues. (auth)

6918 CONTINUOUS FLOW AUTOMATED RADIOIMMUNOASSAY USING ANTIBODIES ATTACHED TO RED BLOOD CELLS. Luner, S. J. (Univ. of California, Los Angeles). Anal. Biochem.; 65: No. 1-2, 355-361(12 May 1975).

Continuous-flow automated radioimmunoassays can be performed using antibodies which have been attached to red blood cells with chromic chloride. To separate the antibody-bound labeled antigen from unbound labeled antigen the erythrocytes are aggregated by Polybrene and separated from the supernatant by decantation. For the determination of serum insulin levels the method was sensitive to within 2 mu U/ml when operating at a sampling rate of 10/hr with a total assay time of 1½ hr. (auth)

6919 NEW AND HIGHLY SENSITIVE ASSAY FOR THE ATP PHOSPHORIBOSYLTRANSFERASE THAT CATALYZES THE FIRST STEP OF HISTIDINE BIOSYNTHESIS. Kronenberg, H. M.; Vogel, T.; Goldberger, R. F. (National Cancer Inst., Bethesda, MD). Anal. Biochem.; 65: No. 1-2, 380-388(12 May 1975).

A new method is described for assaying the ATP phosphoribosyltransferase (EC 2.4.2.17) that catalyzes the first step of histidine biosynthesis in bacterial cells. This is a highly sensitive radioassay, capable of detecting fewer than 10^9 molecules of enzyme. In contrast to the previously available assay, it can be carried out in the presence of other molecules that absorb uv light. The assay may find useful application in studies on the in vitro synthesis of the enzymes for histidine biosynthesis and in studies on the various aggregation states of the enzyme. (auth)

6920 RAPID ASSAY METHOD FOR HYALURONIDASE. Coulson, C. J.; Girkin, R. (May and Baker Ltd., Dagenham, Eng.). Anal. Biochem.; 65: No. 1-2, 427-434(12 May 1975).

Hyaluronidase activity has been measured by a semimicro radiochemical method. ^3H-Hyaluronic acid was prepared using hydrazine to remove some of the acetyl groups followed by reacetylation with tritiated acetic anhydride. Hydrolysis was carried out using an extract from rat liver lysosomes and a cruder extract from other tissues. At the completion of hydrolysis, cetylpyridinium chloride was added to precipitate unreacted substrate. Smaller molecular-weight oligosaccharides produced by hydrolysis remain in solution to be determined by liquid scintillation counting. This assay gives results that are similar to those obtained by the assay using N-acetylglucosamine end-group determination but, in the case of tissue extracts, in 1 hr instead of 18 hr. (auth)

6921 MEASUREMENT OF GLUTAMATE DECARBOXYLASE ACTIVITY IN BRAIN TISSUES BY A SIMPLE MICRORADIOMETRIC METHOD. Moskal, J. R.; Basu, S. (Univ. of Notre Dame, IN). Anal. Biochem.; 65: No. 1-2, 449-457(12 May 1975).

A simple method was developed for the assay of L-glutamate decarboxylase (GAD) in brain homogenate and subcellular frac-

tions. In a dual tube assay system, the incubation mixture (0.1 ml) was placed in an inner disposable culture tube (6 x 50 mm) which was then placed in an outer reusable culture tube (10 x 75 mm) and sealed with a serum cap. The procedure utilizes absorption of $^{14}CO_2$ (released from [1-^{14}C]L-glutamate) on a Hyamine hydroxide spotted Whatman 3MM chromatographic paper strip (5 x 40 mm) which is then counted with a MiniVial containing 5 ml of toluene scintillation solution. Only very small tissue samples (0.05 to 0.4 mg of protein) and minimum manipulations are necessary. The assay method reported here could be used for the measurement of any decarboxylase-catalyzed reaction, provided that suitable carboxyl labeled substrates are employed. (auth)

6922 ARSENICAL PESTICIDES. 168th Meeting of the American Chemical Society, Atlantic City, New Jersey, September 9, 1974. Woolson, E. A. (Ed.). ACS Symposium Series, No. 7. Washington, DC; American Chemical Society (1975). 182p. (CONF-7409115-).

A paper on the determination of traces of arsenic includes a discussion of neutron activation analysis of ^{76}As, substoichiometric isotope dilution using ^{74}As, and other techniques. Other papers were presented on: review of arsenical pesticides; behavior and phytotoxicity of inorganic arsenicals in soils; behavior of organoarsenicals in plants and soils; arsenicals in animal feeds and wastes; microbiological methylation of arsenic; bioaccumulation of arsenicals; arsenic in the environment; a proposed arsenic cycle in an agronomic ecosystem; and simulation of the mobility of arsenic compounds in the environment; a southern Texas case study. (HLW)

6923 QUICK NEW RADIO-IMMUNOLOGICAL METHOD TO ESTIMATE THE PLASMA PROGESTERONE LEVEL. Application for Early Diagnosis of Gestation in Ewes and She-Goats. Terqui, M.; Thimonier, J. (Institut National de Recherches Agronomiques (INRA), 37- Nouzilly (France). Station de Physiologie de la Reproduction). C. R., Ser. D.; 279: No. 13, 1109-1112(23 Sep 1974). (In French).

Early diagnosis of gestation by estimation of the progesterone level in the plasma was obtained by a fast and simple radioimmunological method. This technique does not involve progesterone extraction from the plasma and gives a high degree of accuracy, close to 95% which compares with that of other techniques. (FR)

6924 QUANTITATIVE FUNCTIONAL EXPLORATION OF THE SALIVARY GLANDS. Evaluation of the Salivary Elimination of ^{99m}Tc. Ingrand, J.; Danchot, J.; Menkes, C. J.; Delbarre, F.; Roucayrol, J. C. (Hopital Cochin, 75 - Paris (France)). Nouv. Presse Med.; 4: No. 6, 395-400(8 Feb 1975). (In French).

A method for the quantitative functional exploration of the salivary glands using two objective criteria is proposed: on the one hand the level of fixation in the parotid of technetium-99m injected in the form of its pertechnate and on the other hand by the fraction of radioactivity found in different specimens of saliva collected in the course of a test carried out using a pharmacological agent free of toxic effects, lemon juice. The quantitative results obtained and its simplicity render the method particularly useful in evaluating the course of salivary function in all forms of disorder, pathological or iatrogenic. (FR)

6925 DTPA AND THE ALVEOLO-CAPILLARY MEMBRANE: TRANSPORT MECHANISMS AND THEIR REGULATION. Ducousso, R.; Brazier, J.; Kress, M.; Pasquier, C. (Centre de Recherches du Service de Sante des Armees, Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France)). Pathol.-Biol.; 22: No. 9, 775-782(1974). (In French).

A number of experiments were conducted on rabbits, isolated rabbit lungs and artificial membranes in order to study the kinetics of the passage of DTA through the alveolocapillary membrane. In opposition to ionic materials, DTPA does not enter the cells. Investigations showed that: the diffusion rate of DTPA through the alveolocapillary membrane seemed independent of the concentration gradient at the levels used for treatment of respiratory contaminations; the passage of DTPA from the blood into the alveolar medium was a slow process; the absorption rate from the lung into the blood might be regulated according to the rather low clearance of the blood DTPA by the kidney. (FR)

6926 RADIOIMMUNOLOGICAL ASSAY OF ALPHA-FOETO-PROTEIN IN PLASMA IN PREGNANT WOMEN. Bouix, J. C.; Bidet, R.; Chambron, J.; Brettes, J. P.; Tourne, C.; Gandar, R. (Strasbourg-1 Univ., 67 (France)). C. R. Soc. Biol.; 168: No. 6, 856-860(1974). (In French).

Radioimmunoassay of alpha-foeto-protein in women throughout the pregnancy and during the delivery was carried out. The alpha-foeto-protein rises during the first two trimesters of pregnancy, passes to a maximum of 160ng/ml near 31st-32nd week of pregnancy and then diminishes. (FR)

6927 ROLE OF COMPUTERS IN THE RADIOLOGY. Peleny, G. L. Magy. Radiol.; 27: No. 2, 107-113(Apr 1975). (In Hungarian).

The possibilities of the use of computers in radiology are discussed by the author. The methods of the electronic data processing in the isotope research, such as the computer scintigraphy, the dose calculation in the radiotherapy by means of computers, and the methods of the use of the computers in the roentgenology are discussed. (auth)

6928 NEW SCINTIGRAPHIC METHODS IN THE ISOTOPE DIAGNOSTICS. Martonffy, K. Magy. Radiol.; 27: No. 2, 88-93(Apr 1975). (In Hungarian).

In the field of isotope diagnostics more and more new methods are worked out, yielding precious information for the clinical medicine. Among others, the use of technecium pyrophosphate opened new prospects in the diagnostics. This method is of great importance in the examination of the coronary vessels, in the diagnosis of the lungs, and in the pulmonary isotope examinations. (auth)

6929 VESICLE INTERACTIONS WITH POLYAMINO ACIDS AND ANTIBODY: IN VITRO AND IN VIVO STUDIES. Dunnick, J. K.; McDougall, I. R.; Aragon, S.; Goris, M. L.; Kriss, J. P. (Stanford Univ., CA). J. Nucl. Med.; 16: No. 6, 483-487(Jun 1975).

Artificial spherules or vesicles of 900 A in diameter formed from phosphatidylcholine and gangliosides and enclosing $^{99m}TcO_4^-$ (standard preparation) survive intact in the circulation of the mouse. Polyamino acids and protein have been incorporated into and onto the vesicles; such vesicles remain intact as determined by diffusion dialysis studies and by electron paramagnetic resonance studies of vesicles enclosing spin label. In studying the distribution of polyamino acid-vesicles and protein vesicles in vivo, it was found that the latter distribute differently from standard vesicles or free protein alone whereas aromatic polyamino acid-vesicles concentrate in the liver and spleen to a greater extent than standard vesicles. The permeability and stability characteristics of vesicles may be preserved when they are modified by the addition of protein or polyamino acids and that such modification of vesicles may be associated with an alteration of their fate in vivo. The potential exists to use vesicles as carriers of radiopharmaceuticals and other drugs and to direct the vesicles preferentially to tissue targets in vivo. (auth)

6930 LABELING AND TESTING OF ^{99m}Tc-STREPTOKINASE FOR THE DIAGNOSIS OF DEEP VEIN THROMBOSIS. Persson, B. R. R.; Kempi, V. (Univ. of Lund, Oestersund, Sweden). J. Nucl. Med.; 16: No. 6, 474-477(Jun 1975).

A detailed study has been made of the method for labeling streptokinase with /sup 99m/Tc in order to get a radioactive indicator for rapid scintigraphic visualization of thrombi and emboli. The best method found for preparing /sup 99m/Tc-streptokinase was by reducing /sup 99m/Tc-pertechnetate with 2 mu mole $SnCl_2$ at pH 0.7 and then adding 50,000 to 75,000 IU of streptokinase at a final pH of about 2. After 1 hr of equilibration the labeling efficiency was 75 to 80 percent as determined by the method of gel chromatography column scanning. The dynamic behavior and distribution of /sup 99m/Tc-streptokinase in different organs was studied in rabbits where a high uptake was found in liver. In a clinical investigation using /sup 99m/Tc-streptokinase prepared according to this work, however, the liver uptake in man was only 10 to 20 percent. (auth)

6931 DEMONSTRATION OF A CHEMODECTOMA BY PERFUSION SCANNING: CASE REPORT. Russell, C. D.; Jander, H. P.; Dubovsky, E. V. (Univ. of Alabama Medical Center, Birmingham). J. Nucl. Med.; 16: No. 6, 472-473(Jun 1975).

A carotid body chemodectoma was demonstrated by perfusion scanning using /sup 99m/Tc-MAA. A renal cell carcinoma was also imaged by perfusion scanning using the same radiopharmaceutical. (ERB)

6932 GALLIUM UPTAKE IN BENIGN TUMOR OF LIVER: CASE REPORT. Belanger, M. A.; Beauchamp, J. M.; Neitzschman, H. R. (Charity Hospital of Louisiana, New Orleans). J. Nucl. Med.; 16: No. 6, 470-471(Jun 1975).

A case of positive tracer localization in a benign tumor of the liver on a ^{67}Ga-citrate scan is reported. The authors were unable to find any previous reports of positive localization of gallium in this type of liver tumor. (auth)

6933 PERSISTENT LEFT SUPERIOR VENA CAVA DEMONSTRATED BY RADIONUCLIDE ANGIOCARDIOGRAPHY: CASE REPORT. Stevens, J. S.; Mishkin, F. S. (Martin Luther King, Jr. General Hospital, Los Angeles). J. Nucl. Med.; 16: No. 6, 469 (Jun 1975).

This report presents a patient with a persistent left superior vena cava demonstrated by radionuclide angiocardiography. The appearance is characteristic. (auth)

6934 EVALUATION OF SOFT-TISSUE CALCIFICATIONS IN DERMATOMYOSITIS WITH ^{99m}Tc-PHOSPHATE COMPOUNDS: CASE REPORT. Sarmiento, A. H.; Alba, J.; Lanaro, A. E.; Dietrich, R. (Univ. of Puerto Rico, San Juan). J. Nucl. Med.; 16: No. 6, 467-468(Jun 1975).

A whole-body scan with /sup 99m/Tc- pyrophosphate and ^{85}Sr-nitrate demonstrates extension of calcinosis in one case of dermatomyositis with cutaneous, subcutaneous, and muscular calcinosis. The authors suggest the potential use of ^{99m}Tc-phosphate compounds as an auxiliary instrument in the evaluation of dermatomyositis-polymyositis syndrome. (auth)

6935 POSITIVE ^{18}F BONE SCAN IN A CASE OF OSTEOID OSTEOMA: CASE REPORT. McCombs, R. K.; Olson, W. H. (Long Beach Community Hospital, CA). J. Nucl. Med.; 16: No. 6, 465-466(Jun 1975).

A positive radiofluorine bone scan is reported in a proven case of osteoid osteoma. Activity was localized in the distal right tibia. (ERB)

6936 VISUALIZATION OF NONVASCULAR CRANIAL TUMOR IN CEREBRAL FLOW STUDY: CASE REPORT. Ryo, U. Y.; Siddiqui, A.; Pinsky, S. (Univ. of Chicago). J. Nucl. Med.; 16: No. 6, 462-464(Jun 1975).

Unusual results were obtained from a cerebral blood flow study and a brain scan performed on a patient with an uncommon, nonvascular scalp tumor eventually identified as a proliferating trichilemmal cyst with acanthosis. The tumor accumulated the radionuclide during the early phase of the cerebral flow study, and the increased radioactivity was persistent, being prominently observable in a scan made 3 min and 2 hr after the radionuclide injection. This unusual, positive finding in a cerebral blood flow study of a nonvascular tumor was thought to be a consequence of the higher counting efficiency resulting from the lack of shielding by the skull and from the larger volume of the tumor tissue. (auth)

6937 INTRACEREBRAL HEMORRHAGE DEMONSTRATED BY NUCLEAR CEREBRAL ANGIOGRAM: CASE REPORT. Rockett, J. F.; Kaplan, E. S.; Hudson, J. S.; Moinuddin, M. (Baptist Memorial Hospital, Memphis). J. Nucl. Med.; 16: No. 6, 459-461 (Jun 1975).

Two intracerebral hemorrhages were detected because of vascular displacement on the radionuclide cerebral angiogram. The static brain images in both patients were normal. (auth)

6938 ABNORMAL SPLEEN SCAN FOLLOWING MOPP THERAPY IN A PATIENT WITH HODGKIN'S DISEASE: CASE REPORT. Dickerman, J. D.; Clements, J. P. (Univ. of Vermont, Burlington). J. Nucl. Med.; 16: No. 6, 457-458 (Jun 1975).

A patient with Stage IV-A nodular sclerosing Hodgkin's disease is described who, at initial presentation, demonstrated an apparent large filling defect in the spleen by /sup 99m/Tc-sulfur colloid scan. Following a 6-month course of MOPP therapy, the patient was clinically free of disease although the spleen scan remained unchanged. After laparotomy, the spleen was found to be entirely normal histologically. (auth)

6939 SIGNIFICANCE OF ABSENT OR FAINT KIDNEY SIGN ON BONE SCAN. Sy, W. M.; Patel, D.; Faunce, H. (State Univ. of New York, Brooklyn). J. Nucl. Med.; 16: No. 6, 454-456(Jun 1975).

Seven men, six suffering from widespread bone metastases of prostatic origin and one with urinary bladder carcinoma, demonstrated minimal or no discernible radioactivity in the kidneys and urinary bladder at the time of bone scanning using /sup 99m/Tc-stannous polypho-phate. The mechanism behind this scan finding is thought to be rapid and enhanced uptake of the radiopharmaceutical by pathologic bone. The significance of the faint or absent kidney sign in bone scanning, particularly in cases where abnormally homogeneous and symmetric radioactivity exists, is discussed. (auth)

6940 ANALYSIS OF LIVER SCANNING IN A GENERAL HOSPITAL. Oster, Z. H.; Larson, S. M.; Strauss, H. W.; Wagner, H. N. Jr. (Johns Hopkins Medical Inst., Baltimore). J. Nucl. Med.; 16: No. 6, 450-453(Jun 1975).

The specificity and sensitivity of liver scanning in a general referral population of 125 patients was studied. All patients had a liver biopsy prior to the scan or not more than 10 days later. The results of this study were compared with one earlier and one ongoing study in the same laboratory. The differences in accuracy are mostly attributable to the difference in the populations studied. It is apparent that the multiple-view scintillation camera technique is not superior to the rectilinear two-view scans for studying the liver. (auth)

6941 CHLORINE-CONTAINING ORGANIC CONSTITUENTS IN CHLORINATED EFFLUENTS. Jolley, R. L. (Oak Ridge National Lab., TN). J. Water Pollut. Contr. Fed.; 47: No. 3, 601-618(Mar 1975).

Results obtained using a ^{36}Cl tracer high-resolution chromatographic method to make a detailed examination of the chlorine-containing compounds present in the chlorinated primary and secondary effluents from two domestic sanitary wastewater treatment plants are reported. Stable chlorine-containing organic constituents were present after effluents had been chlorinated to a 1 to 2 mg/l chlorine residual. (MCG)

6942 CALCULATION OF RELATIVE WEIGHTS FOR NUCLEAR MEDICINE PROCEDURES. Waxman, A. D.; Siemsen, J. K. (Univ. of Southern California Medical Center, Los Angeles). J. Nucl. Med.; 16: No. 5, 348-351(May 1975).

Relative weights for nuclear medicine procedures have been assigned previously on the basis of subjective estimates of resources expended. Thus, ultimate values frequently have not reflected time and cost of personnel and equipment accurately. Based on computerized data collected on over 8000 patients, we have attempted to calculate relative weights more objectively by analyzing the following parameters: (a) physician time; (b) technologist time; (c) nurse (or aide) time; (d) equipment time and depreciation; and (e) radiopharmaceutical cost, or cost equivalent. Most major organ scans were found to have quite similar values whereas procedures with low ratings on previous value schedules were found to have high relative values when analyzed objectively. (auth)

6943 FIBRINOGEN UPTAKE BY THROMBI: EFFECT OF THROMBUS AGE. Coleman, R. E.; Harwig, S. S. L.; Harwig, J. F.; Siegel, B. A.; Welch, M. J. (Washington Univ. School of Medicine, St. Louis). J. Nucl. Med.; 16: No. 5, 370-373(May 1975).

The uptake of radiolabeled fibrinogen in canine thrombi was determined at varying times after thrombus induction by electric current. The greatest thrombus/blood ratio was achieved when fibrinogen was administered 4 hr after thrombus induction but definite thrombus fibrinogen uptake was still observed when the tracer was administered up to 72 hr after thrombus induction. There was continued fibrinogen accumulation despite a decrease in weight of older thrombi suggesting that net thrombus propagation is not necessary for labeled fibrinogen uptake. Our results suggest that the fibrinogen uptake test may be useful for the diagnosis of deep vein thrombosis for several days after the onset of thrombosis. (auth)

6944 NUMEDICS: A SYSTEM FOR ON-LINE DATA PROCESSING IN NUCLEAR MEDICINE. Alpert, N. M.; Burnham, C. A.; Deveau, L. A.; Correll, J. E.; Chesler, D. A.; Pizer, S. M.; Brownell, G. L. (Massachusetts General Hospital, Boston). J. Nucl. Med.; 16: No. 5, 386-392(May 1975).

A multiterminal system–NUMEDICS–has been developed to study the problems of on-line acquisition, processing, and display of scintigraphic data. The hardware-software configuration of NUMEDICS permits simultaneous and independent operation of terminals in the Division of Nuclear Medicine, the Physics Research Laboratory, and the Cyclotron Laboratory of the Massachusetts General Hospital. This paper describes the hardware and software developments in NUMEDICS which have proven to be of value in clinical and research applications. These features are illustrated by applications to the evaluation of left ventricular performance, three-dimensional imaging, and functional imaging of rCBF. (auth)

6945 DIGITAL TOMOGRAPHIC IMAGING WITH TIME-MODULATED PSEUDORANDOM CODED APERTURE AND ANGER CAMERA. Koral, K. F.; Rogers, W. L.; Knoll, G. F. (Univ. of Michigan, Ann Arbor). J. Nucl. Med.; 16: No. 5, 402-413(May 1975).

The properties of a time-modulated pseudorandom coded aperture with digital reconstruction are compared with those of conventional collimators used in gamma-ray imaging. The theory of this coded aperture is given and the signal-to-noise ratio in an element of the reconstructed image is shown to depend on the entire source distribution. Experimental results with a preliminary 4 x 4-cm pseudorandom coded aperture and an Anger camera are presented. These results include phantom and human thyroid images and tomographic images of a rat bone scan. The experimental realization of the theoretical advantages of the time-modulated coded aperture gives reason for continuing the clinical implementation and further development of the method. (auth)

6946 UNUSUAL CAUSE OF 'DOUGHNUT' SIGN IN BRAIN SCANNING. Beauchamp, J. M.; Belanger, M. A.; Neitzschman, H. R. (Charity Hospital, New Orleans). J. Nucl. Med.; 16: No. 5, 432-433(May 1975).

The "doughnut" sign in brain scanning was originally described in association with certain mass lesions having central necrotic,

cystic, or avascular areas. A case in which this pattern occurred as a result of a superficial lesion, a large cephalhematoma, is presented. (auth)

6947 PRODUCTION OF CEREBROSPINAL FLUID LEAK ARTIFACT BY RESIDUAL ^{99m}Tc-PERTECHNETATE. Cowan, R. J.; Murphy, M. P.; Maynard, C. D. (Bowman Gray School of Medicine, Winston-Salem, NC). J. Nucl. Med.; 16: No. 5, 434 (May 1975).

Residual oropharyngeal ^{99m}Tc activity was detected on an ^{111}In-DTPA cisternogram creating the appearance of a CSF leak. This can be prevented by employing a spectrometer setting that encompasses only the higher principal photopeak of ^{111}In. (auth)

MATERIALS

Refer also to abstracts 7002, 7003, 7034, 7039, 7073, 7129, 7185, 8027, 8039, 8047, 8049, 8058, 8059, 8076, 8160, 8162, 8198, 8362, and 8363.

6948 (CONF-741232-) EUROPEAN CONFERENCE ON IRRADIATION BEHAVIOUR OF FUEL CLADDING AND CORE COMPONENT MATERIALS, KARLSRUHE, 3–5 DECEMBER 1974. (Kerntechnische Gesellschaft im Deutschen Atomforum e. V., Bonn (F. R. Germany); British Nuclear Energy Society, London; Gesellschaft fuer Kernforschung m.b.H., Karlsruhe (F. R. Germany)). 1974. 192p. (In Several Languages).

Forty-five papers are included, arranged into sessions on void swelling, structural stability, and mechanical properties (in-reactor and post-irradiation). Separate abstracts were prepared for 44 of the papers. (DLC)

For abstracts of individual papers see: 6230, 6949, and 7142–7183.

6949 (CONF-741232-, pp 7-8) SIMULATION BY MANY-BODY INTERACTION OF THE CREATION OF DISPLACEMENT POINTS. Dang Dinh Cung. (CEN, Saclay, France). 1974. (In French).

From European conference on irradiation behaviour of fuel cladding and core component materials; Karlsruhe, F. R. Germany (3 Dec 1974).

In European conference on irradiation behaviour of fuel cladding and core component materials.

A model for the simulation of displacement cascades when the kinetic energy of the atom is very low was developed. This model ANGIANG is analogous to the molecular dynamics model of Vinyard but it takes into consideration the thermal vibration of the atoms and the electron friction and uses the Runge–Kutta iteration method. Preliminary studies have shown that electron friction can be neglected in the simulation and that the selection of the potential model has significant effects on the results. The introduction of the thermal vibration cause a wide dispersion of results on the focalization factor. (JSR)

6950 PROCEEDINGS OF THE SIXTH INTERNATIONAL VACUUM CONGRESS, KYOTO, JAPAN, MARCH 25–29, 1974. Kumagai, H.; Toya, T. (eds.). Japanese Journal of Applied Physics, Supplement 2, Part 1, 1974. Tokyo; Japanese Journal of Applied Physics (1974). 818p. (CONF-740353-).

The conference contained 216 papers. Separate abstracts were prepared for 31 papers. Other papers were outside the scope of NSA. (JFP)

For abstracts of individual papers see: 6215–6220, 6372–6377, 6976–6980, 7088–7090, 7195, 7214, 7274–7277, 7306, 7307, 7381, 7408, and 7409.

Ceramics and Cermets

6951 (AD-787646) ANNEALING OF SPUTTERED BETA SILICON CARBIDE. Berman, I.; Marshall, R. C.; Ryan, C. E. (Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass. (USA)). 1 Oct 1974. 8p. (AFCRL-TR-74-0485). NTIS $3.25.

Using an rf sputtering and etching module, silicon carbide was deposited on the surface of (100) and (111) silicon, (111), (110), (100) tungsten, and (0001) alpha SiC. Almost all deposits were amorphous initially but after thermal annealing, the thin films on the (100) silicon and on (0001) alpha became single crystal layers. Silicones of tungsten were formed on the tungsten substrates after annealing. (GRA)

6952 (AD/A-001815) PRODUCTION ENGINEERING MEASURES TO MANUFACTURE SUPERFINE FINISH BERYLLIA. Quarterly Progress Report, 30 June–30 September 1974. Rees, G. H. (Brush Wellman, Inc., Elmore, Ohio (USA)). 29 Oct 1974. Contract DAAB07-74-C-0606. 32p. (BW-TR-550). NTIS $3.75.

Plans were made and initial work started on the development of processes for the manufacturing of beryllia substrates for microwave integrated circuits, having a surface smoothness not exceeding four microinches per inch, by progressive polishing steps. The primary effort centered on studying lapping variables such as pressure, time, abrasive grit size, substrate material removal rate, and surface smoothness. The first step in the process must provide a flat surface for subsequent polishing while minimizing the degradation of surface smoothness. The results show that 600 grit abrasive, normally used for rough polishing, can be used for this purpose better than other grits examined. (GRA)

6953 (AD/A-001867) EFFECT OF SOLID INCLUSIONS ON CHANGE IN STRUCTURE AND PROPERTIES OF TWO-PHASE ALLOYS UNDER SHOCK LOADING. Bondar, M. P.; Staver, A. M.; Chagelishvili, E. Sh. 15 Nov 1974. Translated by M. Olsechea from pp 549-553 of Gorenie i Vzryv, Moscow, 1972. 13p. NTIS $3.25.

The effects of shock waves on the change in structure and properties of two-phase materials were studied. The influence of size, shape, and the distribution of the solid phase on the structure of the material after shock loading was also studied. The subjects of this study were alloys $Cu-Al_2O_3$ containing a small concentration of the solid phase and alloys WC–CO and W_2C–WC–W containing a high concentration of the solid phase. (GRA)

6954 (AERE-R-7958) PREPARATION AND PROPERTIES OF VANADIUM DIOXIDE FILMS. Smith, F. A.; Hughes, A. E. (UKAEA Research Group, Harwell. Atomic Energy Research Establishment). Feb 1975. 14p. Dep. NTIS (US Sales Only) $4.00. UK 50 pence.

Thin films of vanadium dioxide, which have potential application as display and storage media, have been prepared by reactive sputtering. Optical and electrical properties of the films have been measured. It has been found that the oxygen partial pressure during sputtering has a critical influence on the stoichiometry of the VO_2 films and their properties. (auth)

6955 (CONF-750511-1) MAGNETIC CIRCULAR DICHROISM OF DEFECTS. Modine, F. A.; Major, R. W.; Wilson, T. M. (Oak Ridge National Lab., Tenn. (USA)). 1975. 5p. Dep. NTIS $4.00.

From workshop on defects in magnesium oxide and related materials; Canton, North Carolina, USA (26 May 1975).

Results of magneto-optical studies on R, V^-, F, and F^+ bands in the alkaline earth oxides are presented and discussed. Data are tabulated on absorption energy, spin orbit splitting, and orbital magnetic moment for MgO, CaO, SrO, and BaO. (JRD)

6956 (JEN-291) GRINDING OF URANIUM DIOXIDE FROM FLUIDIZED BEDS. Alonso Folqueras, J. A. (Junta de Energia Nuclear, Madrid (Spain)). 1974. 14p. (In Spanish). INIS.

The vibratory grinding of UO_2 obtained from fluidized beds is studied. The grinding time has been correlated with surface area, stoichiometry, granulometry, and product contamination. The efficiency losses in the grinding of moist UO_2 are outlined. Results of a study of the granulate obtained from the ground UO_2 are presented along with studies of the resulting green pellets, taking into consideration the dispersion of its density and height. (auth)

6957 (KFK–1274/3, pp vp) FUEL PIN DEVELOPMENT. Orians, A.; Vollath, D. Dec 1974. (In German).

12 figs.; 4 tabs.; 2 refs.

In 3rd quarter annual report 1974. (Kernforschungszentrum Karlsruhe (F. R. Germany). Projekt Schneller Brueter).

Further DFR-350 post-irradiation examinations of oxide pins exhibited a phenomenon not experienced before. If the initial stoichiometry is high, a PuO_2 depletion is produced between the areas of maximum rod power and maximum cladding temperature at the central channel, whereas two PuO_2 peaks are produced in the columnar crystal and the compacted porosity zones, and a PuO_2-free layer of up to 100 μm thickness is generated at the surface of the fuel. Possible explanations are discussed for the high plastic cladding strains measured during in-pile experiments. The most probable mechanism seems to be fuel swelling during part-load operation followed by thermal expansion of the fuel as the rod power is raised again. Studies of corrosion on the inside of the walls after irradiation of oxide pins in a fast neutron flux do not indicate any increased depths of attack when the maximum burnup was raised from 6 to 9.7 atom-%. However, the number of points with depths of attack ≳100 μm increases with increasing burnup. Intercrystalline corrosion is the dominating type of attack. A possible alternative to the fabrication of carbide fuels from the respective oxides, which has been investigated by industry with respect to its technical applicability, is a method developed by the IMF in 1972. The pros and cons of this method, which is based on uranyl oxalate-carbon mixtures, are discussed. A process of testing the bonding quality of carbide fuel pins with sodium bonding was tested. (auth)

6958 (N-74-17196) PROCESS DEVELOPMENT FOR Ni–Cr–ThO_2 AND Ni–Cr–Al–ThO_2 SHEET. Cook, R. C.; Norris, L. F. (Sherritt Gordon Mines Ltd., Fort Saskatchewan (Canada)). Dec 1973. 115p. (NASA-CR-134484). NTIS $8.75.

A process was developed for the production of thin gage Ni–Cr–

ThO_2 sheet. The process was based on the elevated temperature deposition of chromium onto a wrought Ni–2 percent ThO_2 sheet and subsequent high temperature diffusion heat treatments to minimize chromium concentration gradients within the sheet. The mechanical properties of the alloy were found to be critically dependent on those of the Ni–2 percent ThO_2 sheet. A similar process for the production of a Ni–Cr–Al–ThO_2 alloy having improved oxidation resistance was investigated but the non-reproducible deposition of aluminum from duplex Cr/Al packs precluded successful scale-up. The mechanical properties of the Ni–Cr–Al–ThO_2 alloys were generally equivalent to the best Ni–Cr–ThO_2 alloy produced in the program. (STAR)

6959 (SAND-74-0323) CRACK INITIATION IN B-AL COMPOSITES. Hoover, W. R. (Sandia Labs., Albuquerque, N. Mex. (USA)). May 1975. Contract AT(29-1)-789. 23p. Dep. NTIS $4.25.

The toughness of notched, unidirectional B–Al composite under 3-point bending has been examined as a function of filament volume fraction, filament diameter, and matrix yield strength. The results illustrate that the work-of-fracture, gamma/sub f/, criterion for composite toughness has only limited utility since gamma/sub f/ was found to be a strong function of notch length. The linear, elastic fracture toughness, K/sub c/, was observed to be independent of both notch length and filament diameter. However, the K/sub c/ values increased significantly as the yield strength of the matrix increased. The critical energy release rate, L/sub c/, was shown to be independent of crack length, filament diameter and matrix yield strength. It has been proposed that L/sub c/ is a reflection of the strain energy stored in the filaments at crack initiation and is thus a measure of the parameter which controls composite crack initiation--strain in the filaments at the notch root. (auth)

6960 (SAND-75-5288) UNIFIED MODEL OF DAMAGE ANNEALING IN CMOS, FROM FREEZE-IN TO TRANSIENT ANNEALING. Sander, H. H.; Gregory, B. L. (Sandia Labs., Albuquerque, N. Mex. (USA)). [nd]. 4p. (CONF-750703-9). Dep. NTIS $4.00.

From IEEE annual conference on nuclear and space radiation effects; Arcata, California, USA (14 Jul 1975).

Results of an experimental study at 76°K, are presented showing that radiation-produced holes in SiO_2 are immobile at this temperature. If an electric field is present in the SiO_2 during low temperature (76°K) irradiation to sweep out the mobile electrons, the holes will virtually all be trapped where created and produce a uniform positive charge density in the oxide. These results are the basis for concluding that if a complimentary p,n metal-oxide semiconductor (CMOS) device is irradiated for sufficient time at 76°K to build-in an appreciable field, further irradiation with gate bias removed will produce very little additional change in V/sub th/, since the field in the oxide tends to keep all generated electrons in the oxide where they recombine with trapped holes. Hence the hole trapping rate equals the hole annihilation rate. The room-temperature annealing following a pulsed gamma exposure occurs in two regimes. The first recovery of V/sub th/ occurs prior to 10^{-4} seconds. The magnitude of this very early-time recovery, at room temperature, is oxide-dependent, and oxide process dependent. The rate-of-annealing is what is truly different between a rad-hard and a rad-soft device, since annealing in the hardest devices occurs very quickly at room temperature. (auth)

6961 (SFB-157-1) LITERATURE STUDY ON THE THERMAL CONDUCTIVITY OF UO_2. Brandt, R.; Haufler, G.; Neuer, G. (Stuttgart Univ. (TH) (F. R. Germany). Inst. fuer Kernenergetik). Dec 1973. 173p. (In German). INIS.

With figs. and tabs.; 231 refs. With abstract. Available from ZAED.

The thermal conductivity of inhomogeneous substances can be studied quite well when using uranium dioxide as an example because this material is available in very different structures and, in addition, many measurements have already been conducted. In connection with measurements of the material properties, a comprehensive literature survey was conducted on the thermal conductivity of UO_2 to see what further experimental work would have to be made, especially in order to improve the knowledge of the thermal conductivity of molten UO_2. (GE)

6962 MAGNETIC SUSCEPTIBILITY OF CERTAIN RARE EARTH TETRABORIDES. Paderno, Yu. B.; Severyanina, E. N.; Fedchenko, R. G. (Inst. of Problems in Materials Science, Kiev). Inorg. Mater.; 10: No. 10, 1633-1634(Oct 1974).

Translated from Izv. Akad. Nauk SSSR, Neorg. Mater.; 10: No. 10, 1900(Oct 1974).

The magnetic susceptibility of GdB_4, HoB_4, and ErB_4 was investigated at 298 to 673°K. It was found that the magnetic susceptibility of these compounds in this temperature range varies according to the Curie–Weiss law, the values of θp being −22.5 and 0°K respectively. (auth)

6963 SOME PROPERTIES OF THE CERAMIC WITH THE COMPOSITION $Y_2O_3 + 2ZrO_2$. Lukin, E. S.; Borovkova, L. B.; Khudak, E. B. (Moscow Chemicotechnological Inst.). Inorg. Mater.; 10: No. 10, 1643-1644(Oct 1974).

Translated from Izv. Akad. Nauk SSSR, Neorg. Mater.; 10: No. 10, 1911-1912(Oct 1974).

Properties of dense, sintered $Y_2O_3-ZrO_2$ ceramics were studied. Data and information are presented on density, mechanical properties, evaporation temperature, electrical properties, microstructure, microhardness, and stability of this system. (JRD)

6964 STRUCTURAL CHARACTERISTICS OF CeO_{2-x}. Solov'eva, A. E. Inorg. Mater.; 10: No. 10, 1555-1557(Oct 1974).

Translated from Izv. Akad. Nauk SSSR, Neorg. Mater.; 10: No. 10, 1813-1815(Oct 1974).

The reduction of CeO_2 at temperatures up to 1200°C was investigated. It was found that reduction of CeO_2 when roasted in air above 1750°C is accompanied by an increase in the lattice constant, growth of the grains, thickening of their boundaries, and by darkening of the specimens. When CeO_2 is roasted in vacuum a change is observed in the phase composition and the appearance of a new phase with a cubic structure of type C. (auth)

6965 PHASE COMPOSITION AND ELECTRICAL CONDUCTIVITY OF SPECIMENS OF THE SYSTEM $ZrO_2-Sc_2O_3$ SINTERED AT 2000°C. Volchenkova, Z. S.; Nedopekin, V. M. (Inst. of Electrochemistry, Ural, USSR). Inorg. Mater.; 10: No. 10, 1562-1566(Oct 1974).

Translated from Izv. Akad. Nauk SSSR, Neorg. Mater.; 10: No. 10, 1821-1825(Oct 1974).

After roasting at 2000°C, changes in crystal structure and electric conductivity in the specimens were measured. It was found that specimens of the system $ZrO_2-Sc_2O_3$, sintered at 2000°C, differ from those sintered at 1550°C both in their phase compositions and in the value of the electrical conductivity. In the region of composition from 0 to 37 mole % Sc_2O_3, in addition to ordinary breaks the Arrhenius curves display jumps due to oxygen-ion conductivity. The temperature of these jumps is more sensitive to a change in the composition of the specimens: in the range from 10 to 20 mole % Sc_2O_3 it increases from 500 to 1060°C proportionally to the scandium oxide content. The process, which is accompanied by an abrupt change in the electrical conductivity, is independent of the partial pressure of oxygen in the gas phase and takes place rapidly and without appreciable temperature hysteresis. Preliminary high-temperature treatment of the specimens affects the character of its occurrence. (auth)

6966 THERMOSTIMULATED LUMINESCENCE OF THE RARE-EARTH ORTHOVANADATES. Khodos, M. Ya.; Fotiev, A. A.; Shul'gin, B. V. (Inst. of Chemistry, Ural, USSR). Inorg. Mater.; 10: No. 9, 1427-1430(Sep 1974).

Translated from Izv. Akad. Nauk SSSR, Neorg. Mater.; 10: No. 9, 1658-1661(Sep 1974).

The thermostimulated luminescence (TSL) of orthovanadates, both in the emission band of the vanadate ion and in the impurity luminescence lines, were investigated. The depths of the capture levels were calculated by the methods of Urbach and Lushchik. It is suggested that the TSL maximums, in the regions of 115 to 125 and 150 to 170°K are due to capture levels caused by defects in the anion sublattice, and that the TSL at 250 to 280°K is due to impurity centers which act as electron-capture levels. The dependence of the TSL intensity on the method of synthesis was also investigated. The intensity of thermoluminescence at about 200°K for specimens obtained from the melt in corundum crucibles is an order of magnitude higher than that for orthovanadates synthesized in a platinum vessel. It is suggested that this effect is due to the presence of microimpurities of Al orthovanadate in the phosphors prepared in corundum crucibles. For excitation by x rays in the region of 15 to 100 keV, the TSL spectrum is practically independent of the radiation energy and irradiation dose. (auth)

6967 REACTIONS IN THE SYSTEM $CoO-B_2O_3-Sm_2O_3$. Rza-Zade, P. F.; Akhmedova, D. A.; Abdullaeva, G. K.; Aliev, O. A. (Inst. of Inorganic and Physical Chemistry, Baku). Inorg. Mater.; 10: No. 9, 1424-1426(Sep 1974).

Translated from Izv. Akad. Nauk SSSR, Neorg. Mater.; 10: No. 9, 1654-1657(Sep 1974).

Using the method of isothermal saturation at 1050°C, phase equilibriums in part of the system $CoO-B_2O_3-Sm_2O_3$ were investigated. The regions of existence of the solid phases of $SmCo(BO_2)_5$ and $SmBO_3$ were characterized. Single crystals of the binary metaborate $SmCo(BO_2)_5$ were x-ray analyzed and their IR absorption spectra described; the latter indicate the existence of boron in threefold and fourfold coordination in them. (auth)

6968 PREPARATION OF THIN FILMS OF RARE EARTH OXIDES AND INVESTIGATION OF THEIR PHYSICAL PROPER-

TIES. Samsonov, G. V.; Gil'man, I. Ya.; Andreeva, A. F. (Inst. of Problems in Materials Science, Kiev). Inorg. Mater.; 10: No. 9, 1417-1419(Sep 1974).

Translated from Izv. Akad. Nauk SSSR, Neorg. Mater.; 10: No. 9, 1645-1648(Sep 1974).

Thin films of oxides of La, Ce, Nd, Sm, Eu, Gd, Dy, Ho, Er, Tm, Yb, and Lu were prepared by reactive evaporation of the corresponding rare earth metal in oxygen. The transmission and resistivity of these films increase with the oxygen pressure. Films of these oxides have a high transparency in the visible and near-ultraviolet regions of the spectrum. The optical forbidden-zone width of rare earth oxide films is between 4.0 and 5.6 eV. The temperature dependence of the resistivity at 20 to 600°C was investigated. With an increase in temperature the resistivity of rare earth oxide films decreases according to an exponential law. The thermal-activation energy of the carriers has been determined. (auth)

6969 TEMPERATURE DEPENDENCE OF THE ELASTIC MODULI OF CUBIC CARBIDES OF THE SYSTEM Zr–Nb–C. Avgustinik, A. I.; Ordan'yan, S. S.; Fishchev, V. N. (Leningrad Technological Inst.). Inorg. Mater.; 10: No. 9, 1399-1402(Sep 1974).

Translated from Izv. Akad. Nauk SSSR, Neorg. Mater.; 10: No. 9, 1623-1627(Sep 1974).

The Young's and shear moduli were determined at 300 to 2000°K by measuring the resonance frequencies of the flexural and torsional oscillations of the specimens. It was found that the temperature dependences of the elastic moduli of cubic carbides of the system Zr–Nb–C are linear in the range 300 to 1800°K. In the series of solid solutions $Zr_{1-x}Nb_xC_{0.9}$ virtually equimolar compositions have minimal temperature coefficients in the elastic moduli, probably owing to the effect of elastic deformation of the crystal lattice and to the characteristics of the electron structure of the carbide phases. The Grüneisen constant and the dimensionless parameter δ have been calculated for cubic carbides of the system Zr–Nb–C; they are 1.4 ± 0.1 and 4.7 ± 0.2, respectively. The thermal-expansion coefficient and the heat capacity of the solid solutions $Zr_{1-x}Nb_xC_{0.9}$ were assessed; like the temperature coefficients of the elastic moduli, the thermal-expansion coefficient has a minimum in the region of equimolar compositions. (auth)

6970 ENTHALPY AND HEAT CAPACITY OF NONSTOICHIOMETRIC VANADIUM MONOCARBIDES AT HIGH TEMPERATURES. Turchanin, A. G.; Guseva, E. A.; Morozov, V. V.; Bolgar, A. S.; Fesenko, V. V. (Inst. of Problems in Materials Science, Kiev). Inorg. Mater.; 10: No. 9, 1395-1398(Sep 1974).

Translated from Izv. Akad. Nauk SSSR, Neorg. Mater.; 10: No. 9, 1619-1622(Sep 1974).

The enthalpy of vanadium carbides of three compositions in the region of homogeneity in the range 1300 to 2500°K were investigated. Equations of the temperature dependence of the enthalpy and heat content of these compounds were derived on the basis of experimental data. The results are discussed from the viewpoint of the bond characteristics of the carbides. The character of the composition dependence of the carbide is due to the nature of the variation of the energy of the M–M bond with an increase in the number of defects of the carbon sublattice. (auth)

6971 PROPERTIES OF SINTERED ALUMINUM DISPERSED WITH TITANIUM AND TUNGSTEN CARBIDES. Misra, P. S.; Upadhyaya, G. S. (Univ. of Roorkee, India). Int. J. Powder Metall. Powder Technol.; 11: No. 2, 129-134(Apr 1975).

Aluminum P/M parts dispersed with up to 8 vol. percent titanium and tungsten carbides were prepared by thermal cycled sintering under vacuum. Hot deformation of sintered specimens at 400°C was carried out. Up to 50 percent reduction and annealing behavior at 250 and 350°C respectively was studied. It was observed that the refractory carbides dispersed matrix gives promising results in mechanical properties at elevated temperatures. (auth)

6972 REACTIONS BETWEEN MOLYBDENUM DISILICIDE AND VANADIUM OXIDES AT ELEVATED TEMPERATURES. Humenik, J. N. Urbana, IL; Univ. of Illinois (1974). 189p. University Microfilms Order No. 75-11,558.

Thesis (Ph. D.)

The reduction of V_2O_5 by $MoSi_2$ was studied in the temperature range of 20 to 700°C in an inert atmosphere. Various compositions were subjected to differential scanning calorimetric (DSC) analysis, and a composition consisting of 50 volume percent $MoSi_2$--V_2O_5 was semiquantitatively studied by means of x-ray diffraction. The results of the analyses showed that the reduction of V_2O_5 by $MoSi_2$ tends toward the formation of V_2O_3, with V_6O_{13} and VO_2 formed as intermediate compounds. The reduction of the V_2O_5 was found to be dependent upon composition, with the greatest degree or reduction occurring in specimens consisting of equal parts, by weight, of V_2O_5 and $MoSi_2$. Compositions consisting of $MoSi_2$ with 9 and 15 mole percent additions of V_2O_3--the V_2O_3 added directly to the $MoSi_2$ or produced through the reaction of $MoSi_2$--V_2O_5 formulations--were heat treated in an inert atmosphere. At temperatures above 1100°C, V_2O_3 was reduced by $MoSi_2$. At 1550°C the products of the reaction were SiO_2 and a complex silicide of the type $(Mo_xV_{1-x})_5Si_3$. The crystallographic structure of the silicide was dependent upon the initial vanadium content in the specimens. A low vanadium concentration favored the formation of a hexagonal structure, while higher vanadium concentrations favored the formation of both the hexagonal and a tetragonal structure. The presence of vanadium-containing silicides in $MoSi_2$ did not improve the oxidation resistance of this material and, more than likely, proved to be detrimental. (Diss. Abstr. Int., B)

6973 PRECIPITATION STUDIES IN SYSTEMS TiC–WC AND ZrC–WC. Brun, M. K. University Park, PA; Pennsylvania State Univ. (1974). 196p. University Microfilms Order No. 75-9761.

Thesis (Ph.D.).

The solid solubility of WC in ZrC was found to vary from 25 mol percent at 1800°C to 65 mol percent at 2550°C. There was no dependence of the solubility on the carbon content of the ZrC used. The WC was observed to precipitate from the supersaturated solid solutions in the form of aligned ribbons, 0.05 to 0.1 mu m thick. The crystallographic relation of the precipitate and the matrix was obtained by TEM work as $(001)_h$ equals $(111)_c$ and $[100]_h$ parallel parallel $[110]_c$. The x-ray peaks of the solid solution split into peaks corresponding to the starting and to the equilibrium solid solution, rather than shifting in a continuous manner between the two positions, thus indicating that nucleation is the rate-controlling process. The microhardness of the solid solution 0.55 WC 0.45ZrC increased by about 10 percent after 30 minutes of annealing and remained approximately constant for up to 50 hours of annealing. The solubility of WC in TiC was found to vary from about 50 mol percent at 2050°C to about 75 mol percent at 2350°C. The rate of precipitation of WC from the supersaturated solid solutions was slower than in the system ZrC--WC, and followed a square root of time-dependence up to 15 hours of annealing. The lattice parameter of the solid solution increased with the annealing time in a manner analogous to the increase in the amount of precipitated WC. The splitting of peaks occurred in all peaks of the precipitated WC, with the exception of the (001) type peaks. The pattern was indexed on an orthorhombic cell, formed by the compression of the hexagonal unit cell along the [110] direction. Compression of WC occurs because the specific volume of the WC is higher than that of the cubic matrix from which it precipitates. Another reason is the higher thermal expansion of the matrix. WC was shown to precipitate in the form of well-aligned, ribbon-shaped particles. The crystallographic orientation of the precipitate and the matrix was found to be $(001)_h$ equals $(111)_c$ and $[100]_h$ parallel parallel $[110]_c$. The microhardness of the solid solution 0.75WC 0.25TiC increased to a distinct maximum of 20 percent above the starting value, after about four hours of annealing, and then decreased. The microhardness of the solid solution 0.65WC 0.35TiC increased to a maximum of about 10 percent above the starting value after about eight hours of annealing. The slower precipitation as well as the smaller hardening effect on the second solid solution are due to its lower supersaturation. The absolute values of hardness of the second solid solution were higher, because of the higher TiC content. The separation of the solid solution 0.75WC 0.25TiC with addition of 10 wt percent of cobalt, at 1450°C proceeded at an extremely rapid rate, with all WC precipitating around the matrix grains. The mechanisms of this reaction is probably the solution of WC in liquid cobalt and precipitation of WC from the cobalt phase outside the matrix grains. It was shown that the solid solutions annealed without cobalt to form the WC precipitates within the matrix grains and subsequently mixed with cobalt and reannealed, retained the original microstructure, and only a small amount of WC precipitated outside the matrix grains. The x-ray peak-broadening technique was used to measure the microstrain in the [001] direction of WC. The strain increased linearly with the annealing time to a value of 1.63×10^{-3} after about nine hours of annealing, and then decreased, approaching asymptotically a value of about 1×10^{-3}. The coherently diffracting domain size also increased linearly with the annealing time, went through a maximum at about ten hours and decreased to a value of about 400 A, which is in good agreement with the results obtained by the TEM work. (Diss. Abstr. Int., B)

6974 PHASE AND PROPERTY STUDIES IN THE SYSTEM B_2O_3—Al_2O_3—SiO_2—P_2O_5. Horn, W. F. University Park, PA; Pennsylvania State Univ. (1974). 227p. University Microfilms Order No. 75-9788.

Thesis (Ph. D.).

Phase relationships and thermal properties of crystalline phases in the quaternary system B_2O_3--Al_2O_3--SiO_2--P_2O_5 were investigated with special emphasis on the relationships between

the compounds with cristobalite type structures; BPO_4, $AlPO_4$ and SiO_2. Reliable data could only be obtained if the starting materials were intimately blended, calcined, encapsulated in platinum tubes and heat treated for weeks and months. The system BPO_4--$AlPO_4$ formed a complete series of solid solutions with the high cristobalite structure above 1200°C which could be brought to room temperature without decomposition. This is thought to be the first chemical stabilization of high C--$AlPO_4$ structure to room temperature even as a persistent metastable phase. Re-examination of the system BPO_4--SiO_2 showed that about 15 mol percent SiO_2 was soluble in BPO_4 and 10 mol percent BPO_4 in cristobalite. The eutectic composition was changed to 20 mol percent BPO_4 at 975°C, and liquid immiscibility was observed in some of the glasses. Differential thermal analysis and x-ray diffraction studies were made of the system $AlPO_4$--SiO_2. Above 1200°C the system was a eutectic partial solid solution type. The eutectic was at 30 mol percent $AlPO_4$--70 mol percent SiO_2 at 1425°C, and 35 mol percent SiO_2 was soluble in C--$AlPO_4$ and 10 mol percent $AlPO_4$ was soluble in cristobalite. The high-low cristobalite transformation temperatures decreased as a function of composition. Phase relationships in the system BPO_4--$AlPO_4$--SiO_2 were studied at 1200°C, and the results were summarized in an isothermal section. Liquid immiscibility was observed in the glasses found in this system. Phase separation was found in quaternary glasses containing 30 to 90 wt percent SiO_2. Cristobalite solid solutions were the most frequently observed crystalline phases in the recrystallized quaternary glasses. (Diss. Abstr. Int., B)

6975 MAGNETIC PROPERTIES OF CUBIC BORIDES. Mathur, R. K. Raleigh, NC; North Carolina State Univ. (1974). 55p. University Microfilms Order No. 75-10,415.

Thesis (Ph. D.).

Magnetic properties of borides between the compositions $Co_{21}Sn_2B_6$ and $Ni_{21}Sn_2B_6$ are investigated. The magnetic properties include the determination of (1) saturation magnetization at room temperature, (2) saturation magnetization at liquid nitrogen temperature, (3) saturation magnetic moments per gram, (4) Bohr magnetons per magnetic atom, and (5) Curie temperatures. The apparatus used for determining the magnetic properties was a vibrating-sample magnetometer with high and low temperature accessories, namely a miniature furnace attachment and a cryostat, capable of operating in the range from liquid nitrogen to 1000°C. Saturation magnetization at liquid nitrogen and the number of Bohr magnetons per magnetic atom were found to be as high as 0.585 Wb/m^2 (5850 gauss) and 0.689 Bohr magnetons for the alloy $Co_{21.17}Sn_{1.74}B_{4.09}$ and as low as 0.0444 Wb/m^2 (444 gauss) and 0.053 Bohr magnetons per magnetic atom for $Co_{3.47}Ni_{12.7}Sn_{1.74}B_{4.09}$. The Curie temperatures ranged from a high of 475°K to a low value of 181°K. The atomic moments of the alloys under investigation appear to lie on the downward branch of the Slater-Pauling curve of atomic moments versus atomic number. Quantitative magnetic information could not be obtained for alloys of compositions between $Co_{3.47}Ni_{12.7}Sn_{1.74}B_{4.09}$ and $Ni_{21.17}Sn_{1.74}B_{4.09}$ because of the limitations of the equipment. (Diss. Abstr. Int., B)

6976 THIN FILM CATHODES OF LANTHANUM HEXABORIDE (LaB_6). Oshima, C.; Horiuchi, S.; Kawai, S. (National Inst. for Researches in Inorganic Materials, Kurakake, Japan). Jap. J. Appl. Phys.; No. Suppl. 2, 281-284(1974).

From 6th international vacuum congress; Kyoto, Japan (25 Mar 1974). See CONF-740353-.

Sublimation studies of LaB_6 have showed that a LaB_6 polycrystal evaporates with nearly stoichiometric composition at high temperature range from 1600 to 2200°C. This process gives the useful means to make a uniform thin film of LaB_6 on any substrate. Values of work function and Richardson parameter of the thin film cathodes have been obtained: $\Phi = 2.61 \pm 0.05$ eV, $A = 41$ A/cm^2deg^2. A reaction between the boron in the thin film and the underlying metal has also been examined. (auth)

6977 SURFACE STUDIES OF SINTERED AND SINGLE CRYSTAL UO_2 BY LOW ENERGY ION BOMBARDMENT. Cavaleru, A.; Vasiliu, F. (Inst. of Atomic Physics, Bucharest). Jap. J. Appl. Phys.; No. Suppl. 2, 339-342(1974).

From 6th international vacuum congress; Kyoto, Japan (25 Mar 1974). See CONF-740353-.

The desorption spectroscopy of trapped gas by low energy ion bombardment in sintered and single crystal UO_2 is used to estimate the threshold energy for entrapment, the trapping coefficient, and its variation with both ion energy and implantation temperature and the activation energy for desorption. By comparing the desorption spectra from sintered and single crystal UO_2 the surface effects are clearly illustrated for sinters and practically nonexistent in single crystals. The same conclusion could be drawn from fractional gas release experiments. From the entrapment studies of nobles gas ions in UO_2, information on gas dissolution, diffusion and bubble formation processes could be derived. Recrystallization of near surface layers and gas bubble production induced by energetic ion bombardment at high doses, observed by TEM, have shown to be closely related to gas release stages. (auth)

6978 ELECTRONMICROSCOPICAL STUDIES OF UO_2 THIN FILMS EVAPORATED ON NaCl SUBSTRATES WITH COLLOIDAL CENTERS. Vasiliu, F.; Topa, V.; Popescu-Pogrion, N. G.; Birjega, M. I. (Inst. of Atomic Physics, Bucharest). Jap. J. Appl. Phys.; No. Suppl., 605-607(1974).

From 6th international vacuum congress; Kyoto, Japan (25 Mar 1974). See CONF-740353-.

Epitaxial fcc UO_2 thin films produced by vacuum evaporation or sputtering techniques are used for electronmicroscopical investigations of radiation damage (fission fragment tracks registration, gas bubbles, and voids). An improvement of the epitaxial growth of vacuum evaporated UO_2 thin films on NaCl substrates doped with AgCl and $PbCl_2$ and electrolytically colored (in order to obtain colloidal centers), comparatively with pure and uncolored substrates is reported in this work. The presence of colloidal centers (Ag^0, Pb^0, Na^0) in NaCl substrates heated at 350°C, ensures a high reproductivity for obtaining thin single crystal films with thicknesses up to 700 Å, for deposition rates ranging between 0.5 to 6 Å/s. The presence of weak subsidiary reflections in the diffraction patterns, observed also in previous works, is attributed to crystallites grown in two (110) orientations rotated by 90° relative to each other. By electron beam heating, some UO_2 thin films, exceeding a critical thickness, are transformed exhibiting finally highly oriented diffraction patterns without extraspots. (auth)

6979 EPITAXIAL DEPOSITION OF NIOBIUM NITRIDE BY SPUTTERING. Kosaka, S.; Onodera, Y. (Tohoku Univ., Sendai). Jap. J. Appl. Phys.; No. Suppl., 613-616(1974).

From 6th international vacuum congress; Kyoto, Japan (25 Mar 1974). See CONF-740353-.

Single crystal films of niobium nitride on MgO single crystals cleaved in air have been prepared by dc sputtering technique in argon with addition of a small amount of nitrogen gas. Deposition rate, substrate temperature, discharge pressure, and substrate-cathode spacing have been varied, and dependence of superconducting transition temperatures and structural characteristics of films on these parameters has been studied. Single crystal films were formed with (100) $[110]_{NbN}$//(100) $[110]_{MgO}$. Epitaxial temperature was lowered by shortening the substrate-cathode spacing and by lowering the discharge pressure. The results are discussed in terms of the effect of arrival energy of the sputtered atoms at the substrate. It was shown that there existed a high temperature limit for the formation of single crystal films. The highest transition temperature of the single crystal was 16.5°K and its width of the transition was 0.08°K. (auth)

6980 NITROGEN DOPED Ta–Al THIN FILM BY dc SPUTTERING. Yamazaki, J.; Kamo, T.; Nakamura, M. (Fujitsu Labs Ltd., Kawasaki, Japan). Jap. J. Appl. Phys.; No. Suppl., 709-712(1974).

From 6th international vacuum congress; Kyoto, Japan (25 Mar 1974). See CONF-740353-.

The Ta–Al film is known to show excellent stability as a resistor; even in films about one-fourth of the Ta–N film's thickness nearly equal resistivity is found. In order to increase the sheet resistance, compared with Ta–N film resistance, Ta–Al–N films are studied, varying their composition and sputtering voltage. The resistivity of the Ta–Al–N film can be two or three times that of the Ta–Al film under regular sputtering condition. By increasing the nitrogen partial pressure, a plateau phenomenon, similar to the case of the Ta–N films, was found. X-ray diffraction reveals an amorphous phase in the plateau region. Experimental results confirmed that the Ta–Al–N film was stable, and the sheet resistance was higher than the value for the Ta–N or Ta–Al films. (auth)

6981 INDEX OF RESISTANCE TO DELAYED FAILURE. Nadeau, J. S. (Univ. of British Columbia, Vancouver); Hay, J. M. J. Can. Ceram. Soc.; 43: 31-36(1974).

Glasses and ceramics have varying sensitivities to delayed failure or static fatigue. An index of this property should be useful in engineering design and possibly in the understanding of the underlying physical and chemical phenomena involved in static fatigue. A delayed failure resistance index (DFRI) is proposed based on a comparison of the V-K_I plot (plot of crack velocity versus stress intensity) for a given material with that of soda-lime glass in distilled water. It is the log ratio of the computed times to failure of the two materials containing equal flaw sizes and stressed to 0.5 K_{IC}. The delayed failure resistance index can then be computed from the relationship: $DFRI = -4.086 - n_x \log .5K_{IC(x)} - \log A_{I(x)} - \log (n_x - 2)$ where n_x and $\log A_I$ are the

slope and intercept of single stage V–K_I curves. The constant term was obtained from Wiederhorn's data [S. M. Wiederhorn, J. American Ceram. Soc., 50, 407-14(1967)] on soda-lime glass. The index has values ranging from 0 for soda-lime glass in water to 61 for pyrolytic graphite in air. (auth)

6982 THERMAL SHOCK RESISTANCE AND MECHANICAL CHARACTERISTICS OF MATERIALS BASED ON ZrO_2. Gashchenko, A. G.; Gogotsi, G. A.; Karaulov, A. G.; Rudak, I. N. (Inst. of Strength, Kiev). Strength Mater.; 6: No. 6, 732-736 (Jun 1974).

Translated from Probl. Prochnosti; 6: No. 6, 76-80(Jun 1974).

The effects of the degree of stabilization of zirconium dioxide based materials on their thermomechanical properties were studied. Commercial zirconium dioxide stabilized with 4, 6, and 8 mole % yttrium oxide heated at 1750°C for 18 h was used. Monoclinic ZrO_2 was added to zirconium dioxide stabilized with 6 and 8 mole % Y_2O_3 in order to regulate the phase composition within wide limits. The mixture was fired at 1750°C for 6 h. The charge for preparation of the samples consisted of a granular mass with different grain sizes–50% 1 to 0.5 mm, 10% 0.5 to 0.8 mm, and 40% less than 0.088 mm. Resulting data on strain properties, fracture temperature variations, shock resistance, and bending strength are presented in plots and tables. (JRD)

6983 CRYSTAL STRUCTURE OF BeB_3. Mattes, R.; Tebbe, K. F.; Neidhard, H.; Rethfeld, H. (Univ., Muenster, Ger.). Z. Anorg. Allg. Chem.; 413: No. 1, 1-9(Mar 1975).

The crystal structure of the boride $Al_{0.06}BeB_{3.05}$ has been determined by a three-dimensional x-ray analysis. The unit cell dimensions are: a = 9.800(1) Å, c = 9.532(1) Å; Z = 26.6; space group: P6/mmm; density 2.43 g/cm^{-3}. The complex structure contains B_{12} icosahedra and other polyhedral units occupied by boron and beryllium atoms. The linkage between the polyhedra is related to the linkage of B_{12} icosahedra in β-rhombohedral boron. The aluminum atoms occupy interstitial sites. (auth)

6984 SELF-DIFFUSION OF NON-METALLIC ATOMS IN INCLUSION PHASES. Andrievskii, R. A.; Gurov, K. P. Fiz. Metal. Metalloved.; 39: No. 1, 57-61(Jan 1975). (In Russian).

By using the formalism of a hole gas, which was used earlier to describe self-diffusion in inclusion phases, an analysis is carried out of the change of activation energy in the region of homogeneity of these phases. It is shown that the kind of change in activation energy is determined by the sign of the replacement energy in the system of non-metallic atoms-structural vacancies in the nonmetallic sublattice. The theoretical results were verified by comparison with experimental results reported in the literature for the carbides of Ti, Zr, and Nb and for the hydrides of Ti and Zr. (tr-auth)

6985 HIGH-TEMPERATURE INTERACTION OF REFRACTORY METALS WITH BORIDES. Gorbacheva, T. B.; Krylov, Yu. I.; Mikova, N. M. Nauch. Tr., Vses. Nauch.-Issled. Proekt. Inst. Tugoplavkikh Met. Tverd. Splavov; No. 14, 239-243(1973). (In Russian).

TiB_2, W–TiB_2, and W–ZrB_2 systems were studied in the range 1200 to 2000°C. Reactivity of the metal (Me) towards the borides fell in the order Nb, Mo, W, while the reactivity of the carbides towards the metals was higher with TiB_2 than with ZrB_2. In the reaction process, diffusion of B from the boride into the metal forms boride phases Me(NbB, Nb_3B, MoB, MoB_2). The activity of the Me-boride reaction is less than that of the Me-carbide reaction. (Ref. Zh.)

6986 STRUCTURE OF THE SURFACE LAYER OF COMPONENTS OF TUNGSTEN CARBIDE: COBALT ALLOYS AFTER A VIBRATION TREATMENT. Chaporova, I. N. Nauch. Tr., Vses. Nauch.-Issled. Proekt. Inst. Tugoplavkikh Met. Tverd. Splavov; 12: 50-64(1973). (In Russian).

Microscopic and x-ray methods were used to study the stress condition and effects of plastic deformation in the surface layers of spheres and cylindrical components of WC alloys subjected to a vibration treatment for 15 min to 2 h at a frequency of 1500 cycles/min and amplitude 3.0 to 3.5 mm. The alloys tested, VK8V [WC 92, Co 8%], VK11V [WC 89, Co 11%], and VK15 [WC 85, Co 15%] had a two-phase structure of WC and a solid solution of W and C in Co. The vibration treatment partially transforms the Co phase cubic modification to hexagonal with the proportion of the latter increasing with the treatment time. The treatment strengthens the alloys, e.g., the strength of VK8V alloy is increased 30% irrespective of the shape of the components. (Ref. Zh.)

6987 RARE-EARTH-OXIDE–METAL EUTECTIC COMPOSITES. Stendera, J. W.; Benzel, J. F. (Georgia Inst. of Tech., Atlanta). J. Amer. Ceram. Soc.; 58: No. 3-4, 116-119 (1975).

Unidirectionally solidified composites of a rare-earth sesquioxide + CeO_2 + (Mo or W) and of CeO_2 + (Mo or W) were grown using the direct-rf-coupling internal-molten-zone technique. The dramatic fiber improvement on addition of CeO_2 to the sesquioxide systems suggests that it provides extra loosely bound oxygen to increase the solubility of the metal in the molten oxide. The composites have extensive areas of ordered eutectic growth containing from 8 to 50 x 10^6 metal fibers/cm^2; the fibers are 0.1 to 0.6 mu m in diameter. Fiber density increased almost linearly as the growth rate was increased from 0.5 to approximately 5.0 cm/h. Slow growth favors the platelet metal morphology over the fiber morphology. Platelets are typically observed in areas where high impurity concentrations would be expected, e.g., at the top of the solidified zone and at grain boundaries. (auth)

6988 HIGH-TEMPERATURE OXIDATION OF GROUP IV METAL BORIDES. Voitovich, R. F.; Pugach, E. A. (Inst. of Problems in Materials Science, Kiev). Porosh. Met., Akad. Nauk Ukr. SSR; No. 3, 70-75(Mar 1975). (In Russian).

Oxidation of compact samples of ZrB_2 and HfB_2 was studied within a temperature range of 500 to 1600°C. It is shown that oxygen (nitrogen) dissolving in the lattice of these borides depends on the protective properties of the scale, decreasing with the temperature rise because of borate formation (900 to 1200°C) and scale sintering (1300 to 1600°C). It is established that high resistance to oxidation of ZrB_2 and HfB_2 is due to borate formation within a definite temperature range (900 to 1200°C) and scale sintering at higher temperatures, which also determined the absence of nitride phases ZrN and HfN on the inner phase interface under these conditions. (auth)

6989 SEMI-INDUSTRIAL METHOD FOR PRODUCTION OF COMPLEX CARBIDES. Grebenkina, V. G.; Dorokhovich, V. P.; Karasev, A. I.; Pedanov, L. G. (Inst. of Problems in Materials Science, Kiev). Porosh. Met., Akad. Nauk Ukr. SSR; No. 2, 92-95(Feb 1975). (In Russian).

On the basis of the investigations carried out it is shown that sintering of the charge consisting of mixture of individual carbides, tungsten, (molybdenum) and black in the Thamman furnace at a temperature of 2500°C for $Ta_{0.4}W_{0.6}C$, $Nb_{0.4}W_{0.6}C$, $Ta_{0.4}Mo_{0.6}C$ and at 2200°C for $V_{0.4}W_{0.6}C$ for 4h is an optimal condition for production of complex carbides. (auth)

6990 NITRIDING SINTERED SOLID ALLOYS. Bondar, V. T. (Inst. of Problems in Material Science, Kiev). Porosh. Met., Akad. Nauk Ukr. SSR; No. 2, 38-43(Feb 1975). (In Russian).

The process of nitriding the solid alloy VK8 (WC – 92.01, Co – 7.93, and C_{free} – 0.06) in a medium of very pure N_2 and in a medium of ammonia with and without a covering of powdered TiN was studied. The process of complex saturation of the solid alloy VK8 with Ti and nitrogen by the method of their simultaneous introduction into a medium of pure nitrogen and a reacting mixture of 95 wt.% Ti and 5 wt.% AlF_3 was discussed. On the basis of the changes in the surface layers of the samples studied the absence of a nitride phase during nitriding in very pure N_2, the formation of C-free zones (increasing with increase of the temperature of the process) during nitriding by ammonia, and the appearance of nitride phases of Ti with a non-stoichiometric composition TiN_x with a microhardness of 1524 ± 67 kg/mm^2 during Ti nitriding (at temperatures above 1000°C) were established. (tr-auth)

6991 THERMODYNAMIC ANALYSIS OF THE REDUCTION OF OXIDES OF IRON AND TUNGSTEN BY HYDROGEN. Gurevich, Yu. G.; Radomysel'skii, I. D.; Barshchevskaya, L. F.; Frage, N. R.; Pozhidaev, Yu. I. (Kurgan Machine Construction Inst., USSR). Porosh. Met., Akad. Nauk Ukr. SSR; No. 2, 5-8 (Feb 1975). (In Russian).

The thermodynamic laws of the chemical reactions occurring during the reduction of mixtures of Fe and W oxides by H_2 were discussed. Phase analysis of diagrams, constructed on the basis of thermodynamic calculations, made it possible to determine the regions of stability of the individual oxide phases in equilibrium with the metallic solutions. From the diagrams it was concluded that during the reduction of oxide mixtures of Fe and W the composition of the metallic solution can change from 100% W to 100% Fe as a function of the temperature conditions. At low temperatures (<1100°C) the reduction proceeds in steps through the formation of $FeWO_4$ and WO_2; however at very high temperatures the simultaneous reduction of the oxides of Fe and W without formation of the wolframite. The presence of non-variant equilibrium proves that the formation of a solid solution of Fe–W is possibly by the simultaneous reduction of all three compounds FeO, WO_2, and $FeWO_4$ at a temperature of 1100°C. The results reported on the phase x-ray structural analysis of the mutual reduction of the oxides of Fe and W agree well with the calculated data. (tr-auth)

6992 DURABILITY OF TUNGSTEN-FREE HARD ALLOYS. Samsonov, G. V.; Voronkin, M. A. (Kiev Polytechnic Inst.). Porosh. Met., Akad. Nauk Ukr. SSR; No. 2, 79-81(Feb 1975). (In Russian).

On the basis of an evaluation of literature data on the strengths of TiC–Ni, TiC–Mo_2C, TiC–Fe, TiC–steel, TiC–NiMo, (TiC–NbC)–NiMo, (TiC–TaC)–NiMo, and WC–Co alloys, it was concluded that the strength of W-free solid alloys is a function of the strength of the solid phase, strength of the binder phase, and the strength of the adhesion between them. (JSR)

6993 TEMPERATURE VARIATION OF THE PARTIAL PRESSURE OF CADMIUM IN THE CADMIUM–TELLURIUM SYSTEM. Sedel'nikov, N. G.; Vayukov, A. V.; Ivanov, Yu. M. (Inst. of Steel and Alloys, Moscow). Russ. J. Phys. Chem.; 48: No. 8, 1245-1247(Aug 1974).

Translated from Zh. Fiz. Khim.; 48: No. 8, 2103-2104(Aug 1974).

The partial pressure of cadmium along the three-phase equilibrium line for cadmium telluride on the cadmium side has been measured by the "dew-point" method from 660 to 1080°C. Up to 980°C, this relation is close to that calculated from Raoult's law. The maximum pressure of 6.4 atm is attained at 1040°C. The limiting solubility of cadmium in the cadmium–tellurium system is in the range from 0.4 to 1 at.% Cd at temperatures between 970 and 1065°C. (auth)

6994 HIGH-TEMPERATURE INTERACTION OF REFRACTORY METALS WITH CARBIDES. Gorbacheva, T. B.; Krylov, Yu. I.; Mikova, N. M. Nauch. Tr., Vses. Nauch.-Issled. Proekt. Inst. Tugoplavkikh Met. Tverd. Splavov; No. 14, 233-239(1973). (In Russian).

The interaction of refractory metals with carbides was studied in the range 1200 to 2000°C using briquettes of metal–carbide powders. The systems studied included Nb–TiC, Nb–VC, Nb–Cr_3C_2, Mo–TiC, Mo–VC, Mo–Cr_3C_2, W–TiC, and W–VC. The reactivity of the metals towards the carbides fell in the order Nb, Mo, W, while the reactivity of the carbides towards the metals increased in the order TiC, VC, Cr_3C_2. The interaction effects are determined by the nature of the diffusion processes, i.e., diffusion of the refractory metal into the carbide phase or diffusion of C from the latter into the metal, the effects in turn depending on the carbide type. (Referativnyi Zh.)

6995 THERMALLY STIMULATED POLARIZATION OF THIN Y_2O_3 FILMS. Gorokhovatskii, Yu. A.; Abolina, N. Ya.; Vanag, S. A. Latv. PSR Zinat. Akad. Vestis, Fiz. Teh. Zinat. Ser.; No. 1, 34-38(1975). (In Russian).

Results of a theoretical analysis and an experimental investigation of thermally stimulated polarization (TSP) in thin Y_2O_3 films are given. Comparison of data on TSP and thermally stimulated depolarization enables to obtain additional information about the polarization mechanism and the nature of the energy levels discovered. (auth)

6996 ACCUMULATION PHENOMENA IN YTTRIUM–ALUMINATE GARNETS AFTER β- AND γ-IRRADIATION. Graver, V. E.; Zirap, V. E.; Krumin'sh, I. Ya.; Linda, I. G. (Riga State Univ.). Latv. PSR Zinat. Akad. Vestis, Fiz. Teh. Zinat. Ser.; No. 1, 29-33(1975). (In Russian).

Radiation induced defects in yttrium-aluminate garnets are investigated using the simultaneous recording methods of thermostimulated luminescence (TSL) and current (TSC) curves. It is shown that temperature up to 600°K is not sufficient for a complete annealing of β- and γ-radiation induced defects. The processes of energy and charge transfer are discussed. (auth)

6997 INTERACTIONS IN THE SYSTEM U–S–Te. Ellert, G. V.; Slovyanskikh, V. K. (Inst. of General and Inorganic Chemistry, Moscow). Zh. Neorg. Khim.; 20: No. 2, 504-508 (Feb 1975). (In Russian).

Interaction of the system U–S–Te (0 to 35 at.% U) was studied in the low-temperature region (up to 1200°C). Boundaries of primary crystallization phases and the location of nonvariant points were determined. (tr-auth)

6998 SYSTEM V_2O_5–$NaVO_3$. Volkov, V. L.; Fotiev, A. A.; Valikhanova, N. Kh.; Belyakov, Yu. M. (Ural Science Center, Sverdlovsk, USSR). Zh. Neorg. Khim.; 20: No. 2, 497-500(Feb 1975). (In Russian).

X-ray and differential-thermal analysis methods were used to study the equilibrium phase diagram of the V_2O_5–$NaVO_3$ system under the conditions of an inert atmosphere. Areas of homogeneity of vanadium oxide bronzes were established at 400°C and atmospheric air conditions: $Na_4V_6O_{15}$ (β) $0.86 \leq x \leq 1.06$ and $Na_xV_2O_{5-y}$ (γ) $1.0 \leq x \leq 1.41$, $0 \leq y \leq 0.17$. The data obtained are compared with EPR spectra of the phases of the system studied. (tr-auth)

6999 CHEMICAL AND PHASE COMPOSITION OF VACUUM CONDENSATES OF CERTAIN REFRACTORY COMPOUNDS. Koval'chuk, V. S.; Kuporev, A. L.; Statkevich, L. K.; Lukash, E. S.; Karal'nik, S. M.; Polishchuk, T. V. (Inst. of Electric Welding, Kiev). Porosh. Met., Akad. Nauk Ukr. SSR; No. 3, 64-69(Mar 1975). (In Russian).

On the basis of the data of chemical, optical, spectral, and x-ray spectrum analyses it is established that hot-pressed TiC, NbC, ZrB_2, and TiB_2 evaporate in vacuum at electron beam heating, congruently—and WC, Cr_3C_2, CrB_2, $MoSi_2$—incongruently. Phase composition of condensates TiC, NbC, ZrB_2, and TiB_2 does not depend on the backing temperature within the range of 500 to 1500°C. (auth)

7000 SOLID-STATE EQUILIBRIUM RELATIONS IN THE TERNARY SYSTEMS TeO_2–MoO_3–MoO_2 AND TeO_2–MoO_3–Te. Bart, J. C. J.; Petrini, G.; Giordano, N. (Montedison Research Labs., Milan). Z. Anorg. Allg. Chem.; 413: No. 2, 180-192 (Apr 1975).

In a study of the solid-state reactions in the ternary systems TeO_2–MoO_3–MoO_2 and TeO_2–MoO_3–Te, approximately 70 selected compositions were sintered at 550°C to attain equilibrium conditions, and solid-state equilibrium relations were characterized by x-ray diffraction. In a large composition range, the interaction of TeO_2 and MoO_3 with the reducing agents MoO_2 or Te leads to the reduced ternary oxide $TeMo_4O_{13}$ (m. p. 748°C), in addition to Te_2MoO_7, Te and (intermediate) molybdenum oxides. The compatibility relations for the binary systems TeO_2–MoO_2 and MoO_3–Te are presented for the first time. In the TeO_2–MoO_3 system, three-phase regions are found: (Te_2MoO_7–TeO_2–Te) on the TeO_2–rich side and ($TeMo_4O_{13}$–MoO_2–Te) on the MoO_3-rich sides with ($TeMo_4O_{13}$–$TeMoO_7$–Te) in the intermediate region. In the MoO_3–Te system, three-phase regions ($TeMo_4O_{13}$–MoO_2–Te), ($TeMo_4O_{13}$–Mo_4O_{11}–MoO_2) and ($TeMo_4O_{13}$–MoO_3–Mo_4O_{11}) were detected. $TeMo_4O_{13}$ presents two allotropic forms (α' for $T < 450$°C, α for $T > 450$°C). Both structures have been characterized by ir and optical reflectance spectroscopy. Unit cell dimensions are also given. (auth)

7001 BINARY OXIDE SYSTEM TeO_2–MoO_3. Bart, J. C. J.; Petrini, G.; Giorandano, N. (Montedison Research Labs., Bollate, Italy). Z. Anorg. Allg. Chem.; 412: No. 3, 258-270(Mar 1975).

Phase analysis of the mixed oxide system TeO_2–MoO_3 by means of x-ray diffraction and optical microscopy indicates the formation of a new phase, α-Te_2MoO_7, stable at room temperature. Below 500°C mixtures of crystalline products are obtained or complete devitrification can easily be induced in the system TeO_2–MoO_3. Above this temperature, tendency to glass formation is observed under the conditions employed, due to the liquidus temperature effect. Quenching of a melt of Te_2MoO_7 yields a dark yellow glass, β-Te_2MoO_7. X-ray and density measurements were used to explore the range of stoichiometry and exclude formation of solid solutions in the system; no apparent relationship exists between the crystal structures of the component oxides and the binary compound. (auth)

Metals and Alloys

Refer also to abstract 6333.

7002 (UCSD-34P162-6) NEW MATERIALS BY LOW TEMPERATURE CONDENSATION. Final Report. Luo, H. L. (California Univ., La Jolla, San Diego (USA). Dept. of Applied Physics and Information Science). 15 Mar 1975. Contract AT(04-3)-34. 12p. Dep. NTIS $4.00.

Activities in research programs are reported on superconductivity, magnetism, amorphous materials, and surface coating. The superconductivity studies are concerned with materials having high critical temperatures and high critical fields. Contributions were made towards the understanding of magnetic properties of $ZrZn_2$ and Cu–Ni. The low-temperature specific heat and crystallization properties of amorphous materials were studied. The mechanical strength of surface layers of carbon on V, Nb, Ta, Mo, and W were studied. (JRD)

7003 TUNGSTEN NEWS, MAY 1975. Tungsten News; 1-21(May 1975).

Research and development activities in W technology are reviewed. Information is included on W metal, WC and related materials, W-base alloys, W recovery and processing, and properties of W compounds. 317 references are included. (JRD)

Corrosion and Erosion

Refer also to abstract 6237.

7004 (AD-786378) SOLID CADMIUM EMBRITTLEMENT OF 4340 STEEL. Hoffner, J. A. (Naval Air Development Center, Warminister, Pa. (USA). Air Vehicle Technology Dept.). 27 Jun 1974. 17p. (NADC-74072-30). NTIS $3.25.

High strength heat treated AISI 4340 steel having 210 to 220 ksi UTS was observed to suffer degraded ductility when exposed to solid cadmium. The critical criteria include effective tensile strain parallel to the Cd/steel interface and intimate Cd/steel contact (oxide free). At moderate temperatures (300°F) exposure for extended periods (100 h) is required to produce the embrittlement effect. The most severe of the test conditions employed produced evidence that intergranular slow growth cracking could occur, resulting in deteriorated load bearing capacity of the material. (GRA)

7005 (CONF-740812-8) OBSERVATIONS ON THE IN-SODIUM CORROSION AND TRIBOLOGY OF ALUMINIDE COATINGS ON INCONEL 718. Whitlow, G. A.; Miller, R. L.; Wilson, W. L.; Galioto, T. A. (Westinghouse Electric Corp., Madison, Pa. (USA)). 1974. Contract AT(11-1)-3045. 19p. Dep. NTIS $4.00.

From 7th annual international Metallographic Society technical conference; Gatlinburg, Tennessee, USA (4 Aug 1974).

In sodium cooled fast reactor systems, the ability of surfaces, which are in contact under sodium to slide relative to one another is critical to the successful operation of many components. Materials selected for application at these interfaces will be under load intermittently or continuously in high temperature liquid sodium for many thousands of hours. During operation, reactor mechanical components such as the duct load pads or core restraint mechanism, will be subject to movement resulting from normal operation, differential thermal expansion, and flow or mechanically induced vibrations. Design requirements for these components have necessitated materials with adequate long term sodium stability at approximately 1150°F, and thermal shock resistance coupled with good wear resistance and low coefficients of friction. Initial experimental investigations are described on the corrosion and tribological behavior of a nickel base alloy, Inconel 718, a material considered for use in these components. Subsequent studies have shown that the incorporation of an aluminide surface layer of Inconel 718, using a commercially available diffusion process, results in reductions in the corrosion rate and friction and wear coefficients. After 2000 hours exposure to 1100°F, low oxygen flowing sodium, the average corrosion rate for the diffusion treated alloy was significantly lower than the 0.06 mpy value recorded for the untreated Inconel 718. Structural integrity of the aluminide layer was maintained even though some aluminum loss was detected. Average dynamic friction coefficients of approximately 0.25 were obtained for the treated material in 1000°F sodium pin on plate tests. No measurable wear of the aluminide coating against itself was observed in these tests. In contrast, Inconel 718 exhibited substantial adhesive type wear. (auth)

7006 (DP-MS-75-20) BLISTERING AND HYDRIDE EMBRITTLEMENT. Louthan, M. R. Jr. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.). 1975. Contract AT(07-2)-1. 23p. (CONF-750605-3). Dep. NTIS $4.25.

From conference on understanding environmental degradation of engineering materials; Blacksburg, Virginia, USA (23 Jun 1975)

The effects of hydrogen on the mechanical properties of metals have been categorized into several groups. Two of the groups, hydrogen blistering and hydride embrittlement, are reasonably well understood, and problems relating to their occurrence may be avoided if that understanding is used as a basis for selecting alloys for hydrogen service. Blistering and hydride embrittlement are described along with several techniques of materials selection and use to minimize their adverse effects. (auth)

7007 (DP-MS-75-21) ROLE OF HYDROGEN IN STRESS CORROSION CRACKING. Louthan, M. R. Jr. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.). 1975. Contract AT(07-2)-1. 17p. (CONF-750605-4). Dep. NTIS $4.00.

From conference on understanding environmental degradation of engineering materials; Blacksburg, Virginia, USA (23 June 1975).

Hydrogen embrittlement has been postulated as a cause of stress corrosion cracking in numerous alloy systems. Such an interrelationship is useful in design considerations because it permits the designer and working engineer to relate the literature from both fields to a potential environmental compatibility problem. The role of hydrogen in stress corrosion of high strength steels is described along with techniques for minimizing the susceptibility to hydrogen stress cracking. (auth)

7008 (DP-MS-75-36) METALLURGY OF STRESS CORROSION CRACKING. Donovan, J. A. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.). 1973. Contract AT(07-2)-1. 28p. (CONF-750605-1). Dep. NTIS $4.50.

From conference on understanding environmental degradation of engineering materials; Blacksburg, Virginia, USA (23 Jun 1975).

The susceptibility of metals and alloys to stress corrosion is discussed in terms of the relationship between structural characteristics (crystal structure, grains, and second phases) and defects (vacancies, dislocations, and cracks) that exist in metals and alloys. (auth)

7009 (DP-MS-75-42) HYDROGEN ENVIRONMENT EMBRITTLEMENT. Donovan, J. A. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.). 1975. Contract AT(07-2)-1. 38p. (CONF-750605-2). Dep. NTIS $5.00.

From conference on understanding environmental degradation of engineering materials; Blacksburg, Virginia, USA (23 Jun 1975).

Exposure of many metals to gaseous hydrogen causes losses in elongation, reduction of area, and fracture toughness, and causes increases in slow crack growth rate or fatigue life compared with values obtained in air or vacuum. Hydrogen pressure, temperature, and purity significantly influence deleterious effects. The strength and structural characteristics of the metal influence the degradation of its properties by hydrogen. Several theories have been proposed to explain the loss of properties in hydrogen, but none has gained wide acceptance. The embrittlement mechanism and the role of diffusion are, therefore, open questions and need more quantitative experimental data both to test the proposed theories and to allow the development of realistic preventive measures. (auth)

7010 (KFK-1274/3, pp vp) CORROSION TESTS AND COOLANTS ANALYSIS. Borgsted, H. U.; Drechsler, G.; Frees, G. Dec 1974. (In German).

4 figs.; 2 refs.

In 3rd quarter annual report 1974. (Kernforschungszentrum Karlsruhe (F. R. Germany). Projekt Schneller Brueter).

Structural material samples unloaded from the sodium high temperature corrosion loop after 5,000 hours of testing showed structural changes besides the carburization defected before. This affects much larger areas than the ferritic layers proper. (auth)

7011 (SAND-75-6006) SURFACE TREATMENT OF ZIRCONIUM ALLOYS BY MOLTEN OXIDIZING SALTS. Hardy-Grena, C.; Avogadro, A.; Wurm, J. G. Apr 1975. Translation of EUR-3476.f. 32p. Dep. NTIS $4.75.

A method of coating zirconium alloys by superficial oxidation has been developed, consisting of treatment of the specimens in a bath of molten sodium nitrate. Corrosion tests on the treated samples using hydrogen and chlorine-free terphenyl gave satisfactory results. On the other hand, terphenyl containing 5 ppM Cl_2 strongly attacks the alloys, probably because of the catalytic action of the chlorine on hydrogenation. (auth)

7012 (WARD-NA-3045-21) SODIUM TECHNOLOGY PROGRAM: COMPONENT MATERIALS COMPATIBILITY. Quarterly Progress Report for Period Ending Januray 31, 1975. Ray, W. E. (Westinghouse Electric Corp., Madison, Pa. (USA). Advanced Reactors Div.). May 1975. Contract E(11-1)-3045. 54p. AT.

Activities in research programs are reported on carbon and nitrogen transfer in alloys exposed to liquid sodium, and sodium effects on mechanical properties of Inconel 718 and 316 stainless steel. (JRD)

7013 EFFECTS OF Cr, Mo, AND W ON Na_2SO_4 INDUCED HIGH TEMPERATURE CORROSION OF Ni. Reising, R. F. (General Motors Research Labs., Warren, MI). Corrosion; 31: No. 5, 159-163(May 1975).

Operating gas turbine engines are susceptible to a phenomenon called hot corrosion. Hot corrosion is generally attributed to the interaction of nickel-base turbine blade alloys with ingested sodium sulfate. Two mechanisms were presented previously to account for the surface and grain boundary corrosion of nickel metal. The effects of chromium, molybdenum, or tungsten, or their corrosion products on the corrosion of nickel metal were studied. The corrosion products considered are the oxides and sodium-oxygen compounds. The corrosion products of molybdenum and tungsten enhance the sodium sulfate-induced corrosion of nickel to the same degree as the metals themselves while those of chromium do not. The enhanced corrosion caused by sodium molybdate or tungstate suggests that more than a simple acid-base phenomenon is involved. The formation of a triable, porous film caused by the presence of nickel molybdate or tungstate is proposed as the mechanism responsible for this enhancement. This mechanism is consistent with that proposed by Lashka and Glezer who associated the intensified oxidation of molybdenum-containina nickel alloys with a sub-layer oxide scale containing nickel molybdate. (auth)

7014 CORROSION RESISTANCE OF TRIP STEELS. Baghdasarian, A. (Iranian Oil Co., Tehran); Ravitz, S. F. Corrosion; 31: No. 5, 182-184(May 1975).

Anodic polarization tests on certain metastable austenitic (TRIP) steels having very high strength and good ductility, with contents of sulfur, phosphorus, and other impurities comparable to those of commercial alloy steels, indicate they would have about the same general corrosion resistance as commercial Type 316 stainless steel and appreciably better resistance to pitting in sea water. Cold-working of a TRIP steel increased its resistance to pitting somewhat and decreased its indicated general corrosion resistance slightly; these effects appear to be due to the transformation of austenite to martensite as a result of the cold-working rather than to the cold-working itself. (auth)

7015 ANODIC DISSOLUTION OF A Mo–W ALLOY IN A SOLUTION OF AMMONIUM NITRATE WITH HYDROGEN PEROXIDE BEING PRESENT. Ishankhodzhaev, S.; Tsyganov, G. A. (Inst. of Chemistry, Tashkent). Dokl. Akad. Nauk Uzb. SSR; No. 10, 30-33(1974). (In Russian).

An alloy containing 50% Mo and 50% W was dissolved anodically, and the content of Mo and W both in solution and in the precipitate was determined photocolorimetrically. Quantitative determinations of Mo and W in the electrolyte showed that the dissolution rate of molybdenum is significantly greater than that of tungsten. The rate of anodic dissolution depends on the current density under otherwise equal conditions. The presence of hydrogen peroxide promotes dissolution of the alloy. However, even at an increased current density of 1 to 5 A/dm^2 the dissolution rate of tungsten does not exceed 2 mg/cm^2-h, a value which has no practical significance. (SJR)

7016 ANODIC POLARIZATION BEHAVIOR OF HIGH-PURITY 13 AND 18 PERCENT Cr STAINLESS STEELS. Lizlovs, E. A.; Bond, A. P. (Research Lab. Climax Molybdenum Co. of Michigan, Ann Arbor). J. Electrochem. Soc.; 122: No. 6, 719-722(Jun 1975).

Potentiodynamic polarization curves were obtained in N H_2SO_4 and in N HCl for 13 and 18 percent Cr ferritic stainless steels containing 0 to 5 percent Mo. The critical current density for passivation was decreased by molybdenum additions in both acids, the decrease being more pronounced for the 18 percent Cr steels than for the 13 percent Cr steels. No complete passivity was obtained for the 13 percent Cr steels, even with the 5 percent Mo addition, in N HCl. The addition of 1 percent Mo to 18 percent Cr steels resulted in complete passivity in N HCl. Pitting potentials in M NaCl at 25°C increased linearly with molybdenum content. Pitting potentials increased more rapidly for the 18 percent Cr steels than for the 13 percent Cr steels. All alloys suffered pitting corrosion in 10 percent $FeCl_3$; however, alloys of higher Cr–Mo content were the least pitted and showed the smallest weight losses. (auth)

7017 EFFECT OF ARSENIC ON THE COMPOSITION AND OPTICAL CONSTANTS OF IRON PASSIVE FILM REDUCED AT 100 PERCENT CURRENT EFFICIENCY. Agius, B.; Siejka, J. (Groupe de Physique des Solides de l'Ecole Normale Superieure, Paris). J. Electrochem. Soc.; 122: No. 6, 723-730(Jun 1975).

Nuclear reaction microanalysis, Rutherford backscattering of 1.8 MeV $^4He^+$ ions, and ellipsometric techniques have been used to investigate cathodic reduction of iron passivated in ^{18}O enriched neutral solutions containing arsenic. Arsenic inhibition allows the reduction to take place at –3°C with 100 percent current efficiency. Thus reduction of iron from Fe^{2+} to Fe^0 and of hydrogen was completely inhibited. It was found that arsenic could only adsorb if the surface was oxide free. During cathodic reduction, the composition and optical constants of the film remain constant (n*/sub ox/ equals 1.47 – 0.80i for a layer with initial thickness of 30A), but during passivation of the film they vary with the oxidation potential. (auth)

7018 STUDY OF THE ANODIZATION OF NIOBIUM USING THE METHOD OF OPEN-CIRCUIT TRANSIENTS IN AQUEOUS AND NONAQUEOUS SOLUTIONS. Daly, C. M.; Keil, R. G. (Univ. of Dayton, OH). J. Electrochem. Soc.; 122: No. 6, 730-733(Jun 1975).

The anodic oxidation of niobium in glacial acetic acid-sodium tetraborate solution and in aqueous boric acid-sodium tetraborate solution has been studied over a potential range of 74V using the open-circuit transient analysis technique. The results indicate that the relationship between the formation current density, i, and the formation potential, V, is of the form i equals I/sub 0/ exp (V/V/sub 0/) where I/sub 0/ and V/sub 0/ are parameters resulting from data analysis. V/sub 0/ was found to be a linear function of the formation voltage. The quantity, theta, was found to be essentially equal to zero, a result which agrees with results previously reported for vanadium and molybdenum. Attempts were made to correlate the results with film structure. (auth)

7019 EFFECT OF TEMPERATURE ON DISSOLUTION OF STEELS WITH Mo COATINGS IN H_2SO_4. Sharov, V. M.; Kozlov, E. I.; Karpinos, D. M.; Zil'berberg, V. G.; Biryukov, N. I. (Inst. of Problems in Materials Science, Kiev). Porosh. Met., Akad. Nauk Ukr. SSR; No. 3, 60-63(Mar 1975). (In Russian).

Results of studies are presented on the effects of molybdenum coating on the dissolution rate and electrochemical characteristics of carbon steel in sulfuric acid. It is shown that the coatings inhibit the steel corrosion rate in 1N · H_2SO_4 solutions at 25 to 90°C. Coated steel electrodes in H_2SO_4 solutions have a more positive potential (by 100 to 150 mV). With an increase of the coating thickness the value of steel corrosions stationary potential displacement towards the positive side rises. (auth)

Preparation and Fabrication

Refer also to abstracts 5966, 6370, 8027, and 8299.

7020 (AED-CONF-74-538-044) DEVELOPMENT OF DISSIMILAR MATERIAL WELDING. Method of the Pressure Tube–Extension Tubes for the Prototype Advanced Thermal Reactor FUGEN. Morisawa, J.; Shibatoh, E.; Koyama, T.; Minato, A.; Watanabe, K. (Hitachi Ltd., Tokyo (Japan)). 1974. 12p. INIS.

From 2nd international colloquium on welding in nuclear engineering; Duesseldorf, F. R. Germany (23 Oct 1974).

Available from ZAED.

Factors investigated were best possible welding parameters for hand welding processes for buffering and for the automatic TIG butt welding, best electrode combinations, and analysis of the mechanical properties of the welded joints. (GE)

7021 (AGARD-R-627) ADVANCED MANUFACTURING METHODS AND THEIR ECONOMIC IMPLICATIONS: SOME PILOT PAPERS ON POWDER METALLURGY AND JOINING. (Advisory Group for Aerospace Research and Development, 92 - Neuilly-sur-Seine (France)). Mar 1975. vp. (In English and French).

Six papers, given before the AGARD Structures and Materials Panel in the Spring and Fall of 1974, are contained. These six papers explore the latest state-of-the-art and the potentials for future development of various methods of fabrication of aerospace hardware. Analyzed are such areas as metal joining methods, production techniques for dispersion-strengthened materials and various aspects of powder metallurgy. The six papers contained in the report constitute a pilot effort by the Structures and Materials Panel to determine the direction of future work of the Panel in this important field. (auth)

7022 (LA-tr-75-10) CASTING AND SOLIDIFICATION OF URANIUM IN CERAMIC MOLDS. Defretin, G.; Cottin, R.; Ach, J. N. Translated from Fonderie; 38: No. 320, 45-58(Feb 1973). 32p. Dep. NTIS $4.75.

The casting and solidification of slender half-spheres of uranium in ceramic molds with a base of electrofused silica was studied. The mold is preheated to about 200°C in the equatorial plane (bottom part of the piece) and to 1050°C at the pole (top part). The feeder head, located at the pole, accounts for 2.5 percent of the weight. Different casting speeds and temperatures were tried. They define regions in which cold drops or air pockets may form. There is only one condition that leads to castings without defects: casting at 1330°C in 34 seconds. Thermal analysis of the solidification process shows that there are pyrometric errors that may reach 70°C, due to conduction along the thermocouple wires. On the other hand, the solidification time can be determined precisely. It is two minutes for the lower half of the half-sphere and five minutes for the upper half, or seven minutes in all. The solidification front can be traced from the beginning to the end of the solidification process. It is U-shaped for the lower half and plane for the upper half of the casting. Theoretically these conditions are satisfactory for the production of a casting with no defects, as is experimentally confirmed. (tr-auth)

7023 (RFP-1827) DEVELOPMENT AND PILOT PRODUCTION OF THREE INGOT-SOURCE BERYLLIUM SHEET METAL PARTS. Floyd, D. R. (Dow Chemical U.S.A., Golden, Colo. Rocky Flats Div.). 7 May 1975. Contract AT(29-1)-1106. 18p. Dep. NTIS $4.00.

Results of an extensive development program aimed at making three, separate, structural components from beryllium, using sheet-metal fabrication methods, are presented. Ingot-source beryllium sheet at thicknesses of 0.100, 0.125, and 0.170 inch is formed in a fully-recrystallized and in a partially-recrystallized condition. The tensile yield strength is 26,000 psi after full recrystallization. After partial recrystallization, tensile yield strength is between 35,000 and 45,000 psi, depending upon sheet thickness, heat treat temperature, and time at temperature. The high yield strength is retained in the parts after forming. (auth)

7024 (SAND-75-0192) PREPARATION OF DAMAGE-FREE SURFACES OF METAL SINGLE CRYSTALS FOR ION CHANNELING. Swier, R. G. (Sandia Labs., Albuquerque, N. Mex. (USA)). Apr 1975. Contract AT(29-1)-789. 14p. Dep. NTIS $4.00.

Several polishing techniques have been developed for obtaining damage-free surfaces on metallic single crystals. These polishing techniques include mechanochemical, a combined mechanical-chemical process, and electropolishing, a common electrical-chemical process. The use of these techniques to prepare reproducible damage-free surfaces on Al, Cr, Cu, Mo, and W single crystals for use in ion channeling experiments is described. (auth)

7025 (UCRL-76678) ADIABATIC SURFACE THERMOMETER FOR IMPROVED PRODUCTION BRAZE QUALITY. Dittbenner, G. R. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 25 Mar 1975. 10p. (CONF-750446-1). Dep. NTIS $4.00.

From 15th IMOG joining subgroup meeting; Richland, Washington, USA (1 Apr 1975).

Development of an adiabatic thermocouple probe, suitable for high-vacuum, high-temperature applications is described. This probe development enabled complete automation of production brazing processes. Use of the temperature control system has minimized variables such as the effects that welding operators have introduced into the production parts. Rejection of production parts for failure in the braze joints has been minimized. (JRD)

7026 (WANL-TME-672(Pt.1)) GADOLINIUM–STAINLESS STEEL DEVELOPMENT. Part I. Begley, J. A. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 3 Feb 1964. 19p. NTIS $4.00.

Declassified 12 Sep 1973.

Processing procedures were developed by Carpenter Steel Company for the production of large ingots of AISI 304 + 1 w/o Gadolinium. The material was evaluated at WANL for use in neutron-absorbing cluster plates. Tensile properties, both notched and plain, were determined over the temperature range −328°F to 900°F. Over this temperature range the material met the design requirements for strength and ductility. Metallographic results showed the Gd-bearing phase to be finely dispersed throughout the structure. Chemical analysis confirmed the homogeneous distribution of Gd. Radiation damage is not expected at the environmental flux level of cluster plates for a 20-minute NERVA hot test. (auth)

7027 OXIDATION OF SUPERALLOYS IN IMPURE HELIUM. Sakakibara, M.; Banno, I.; Sekino, S. (Nippon Steel Corp., Kitakyushu, Fukuoka. Technical Research Inst. of Yawata Works). Tetsu To Hagane; 60: No. 12, 1655-1660(Sep 1974). (In Japanese).

An investigation was made to clarify the corrosion of several superalloys in impure helium. The corrosion in helium was more severe than in air. This corrosion was due to the insufficiency in supply of oxidizing species to form a continuous protective scale. For this reason, the severe corrosion occurred with the formation of Cr-denuded zone and with internal oxidation. This oxidation could be reduced by the surface treatment, such as calorizing and pre-oxidizing in air to form a protective film on the surface. (auth)

7028 PRODUCTION OF ERBIUM AND PALLADIUM FLAKES WITH SUBMICRON THICKNESSES. German, R. M.; Ham, V. (Sandia Labs., Livermore, CA). Int. J. Powder Metall. Powder Technol.; 11: No. 2, 97-100(Apr 1975).

Erbium and palladium powders have been milled into submicron thick flakes with aspect ratios of 25 and 300, respectively. A reduced speed attrition milling process developed for this purpose is described. The properties of the resultant flakes make them attractive for hydrogen solid storage applications. The techniques described are applicable to many other metals. (auth)

7029 EFFECTS OF CERTAIN PROCESS VARIABLES ON VAPOR-DEPOSITED TUNGSTEN. Hoertel, F. W. Electrodeposition Surface Treat.; 2: No. 5, 327-341(Aug 1974).

The effects of some process variables on the grain size, grain type, and microhardness of vapor-deposited W were studied, and the near-optimum parameters for the vapor-deposition process determined. No significant changes were observed as a result of ultrasonic vibration of the substrate, variations in the H: WF_6 ratio, or small increases in pressure. Individual additions of butane ~2, CO_2 ~ 24, or propane ~4 vol.% to the gas mixture produced deposits with the finest grain-size, in each case without altering the microstructure. (Metals Abstr.)

7030 RHENIUM AND RHENIUM–TUNGSTEN DEPOSITION BY THERMO-CHEMICAL REDUCTION OF THE HEXAFLUORIDES: A PRELIMINARY STUDY. Hoertel, F. W.; Donaldson, J. G. Electrodeposition Surface Treat.; 2: No. 5, 343-353(Aug 1974).

Near-optimum parameters for the vapor deposition of Re on heated Cu substrates by H reduction of ReF_6 were determined. High-purity deposits of nearly 90% of theoretical density could be obtained. Deposition efficiences, based only on the coherent metal, were 70 to 75%. The average microhardness was 907 Knoop (100 g load). Limited investigations on the deposition of Re–W alloys by reduction of the mixed hexafluorides are also described. (Metals Abstr.)

7031 WELDABILITY OF AUSTENITIC STEELS. Determination of Their Tendency to Different Kinds of Cracking. Leclou, A.; Soulat, P.; Viard, R.; Delattre, A.; Filliette, H.; Fouquart, M. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Recherches Metallurgiques Appliquees). Metaux (Corros.-Ind.); 49: No. 590, 341-372(Oct 1974). (In French).

From meeting on welding metallurgy; Marseille, France (8 Nov 1973).

Tests were performed on austenitic steels to evaluate their resistance to the following types of cracking: hot cracking of the heat-affected zone during welding, determined by the "VARESTRAINT" test (variable deformation); relaxation cracking of the heat-affected zone in a welded assembly, using a small flanged assembly including one of two circular welds. The VARESTRAINT test offers good possibilities for the estimation of the hot cracking tendency of metals. To obtain an overall view of the cracking capacity of the material it is necessary to consider three criteria: total cracking length, elongation beyond which cracking takes place and maximum length of the cracks. Attempts to predict the cracking behavior as a function of chemical composition prove difficult and unreliable, the only correlation established being with the ferrite content. Comparison with industrial experience shows the validity of predictions made from the VARESTRAINT test, which thus seems to be well suited as a means of estimating the hot cracking tendencies of metals. The study of relaxation cracking by means of flanged specimens showed that large cracks only appear for stabilized steels, some of which nevertheless behave satisfactorily. Cracks begin to show in samples kept for 1500 h at 600 deg C, confirming the results of short-duration tests carried out at 750 deg C. The two kinds of cracking investigated are independent of each other, although hot cracking can initiate relaxation cracking. (FR)

7032 REACTIONS BETWEEN THE Ta–Pt–Ta–Au METALLIZATION AND PtSi OHMIC CONTACTS. Day, H. M.; Christou, A.; Weisenberger, W. H.; Hirvonen, J. K. (Naval Research Lab., Washington, DC). J. Electrochem. Soc.; 122: No. 6, 769-772(Jun 1975).

The purpose of this work was to determine processing and/or operating limitations of the proposed microwave power transistor metallization scheme consisting of Si/PtSi–Ta–Pt–Ta–Au. Typical Si–PtSi ohmic contacts were processed and metallized along with larger area wafers and annealed at temperatures from 400 to 785°C. Small area contacts were checked for variation of contact resistivity and the large area metallizations were examined by Auger electron spectroscopy (AES), Rutherford backscatter (RBS) analysis, and x-ray diffraction at a 5° glancing angle. Evidence of significant interdiffusion and chemical interaction at 400°C was absent. Above 600°C tantalum was found to react with gold and PtSi to form various compounds. Consumption of silicon from the substrate accompanied the formation of $TaSi_2$ with the formation of PtSi as an intermediate step. These thermochemical reactions with the accompanying diffusions which take place at temperatures in the range sometimes used for device processing could significantly alter device geometry and, therefore, device performance. At normal operating temperatures and temperatures up to 400°C the PtSi–Ta–Pt–Ta–Au system appears to be adequately stable. (auth)

Properties, Structure, and Phase Studies

Refer also to abstracts 7663, 8019, and 8177.

7033 (AD-750593) HOT-HARDNESS INVESTIGATION OF REFRACTORY METALS AND ALLOYS. Philleo, C. H.; Sale, D. H. (Army Weapons Command, Rock Island, Ill. (USA). Weapons Lab.). Sep 1972. 30p. (SWERR-TR-72-63). NTIS $3.00.

The investigation was conducted to determine the hardness of several refractory metals and alloys at temperatures from 70 to 2000°F. Microhardness tests were made in vacuum under controlled conditions to provide comparable screening data for predicting the strengths of these materials in high-temperature applications such as gun barrel liners. Materials tested included tungsten, molybdenum, niobium, tantalum, niobium-base alloys, and tantalum-base alloys. Chromium plate and Cr–Mo-V steel, currently used in gun barrels, were also tested for comparison. (GRA)

7034 (AD-787430) SHAKEDOWN OF UNIDIRECTIONAL COMPOSITES. Interim Technical Report No. 5. Tarn, J. Q.; Dvorak, G. J.; Rao, M. S. M. (Duke Univ., Durham, N. C. (USA). Dept. of Civil Engineering). Apr 1974. 46p. NTIS $3.75.

Substantial shakedown effects in unidirectional metal matrix composites have been found to exist for loading states which are axisymmetric with respect to the fiber axis, and which include also a uniform thermal change. The shakedown limits for a variable cyclic loading program, can be found by a standard procedure involving the selection of parametric families of self-stress states. An alternative, direct approach to the determination of the shakedown limits is related to the recently developed kinematic hardening rules for symmetrically loaded fibrous composites. Specifically, shakedown occurs if the loading domain can be contained within a translated initial yield surface in the axisymmetric stress plane. Results are presented for B–Al, Be–Al, B–Ti, and B–Mg composites. (GRA)

7035 (AD/A-002629) SYNTHESIS AND CHARACTERIZATION OF ELECTROMAGNETIC MATERIALS. Final Report, 1 November 1972–30 June 1974. Bertke, R. V.; Henes, J. D.; Jones, R. L.; Searle, C. W. (Dayton Univ., Ohio (USA). Research Inst.). Sep 1974. Contract F33615-73-C-5020. 73p. (UDRI-TR-74-37; AFML-TR-74-205). NTIS $4.25.

Research on rare-earth magnetic materials and the electrical and optical properties of semiconductors is reported. Studies were made of the magnetization reversal process in RCo_5 particles and sintered permanent magnets and experimental verification of a model for the magnetization reversal in RCo_5 particles were conducted. Research studies were conducted on both the optical and electrical properties of defect centers in semiconductors. A wavelength modulation spectrometer was designed to investigate the electrical characteristics of defects in $Hg_xCd_{1-x}Te$. (GRA)

7036 (AED-CONF-74-516-006) THE INFLUENCE OF SURFACE STRUCTURE ON THE CRITICAL CURRENT DISTRIBUTION IN SUPERCONDUCTING VANADIUM. Reynders, L.; Deprez, E.; Bruynseraede, Y. 1974. 5p. INIS.

From international discussion meeting on flux pinning in superconductors; St. Andreasberg, F. R. Germany (23 Sep 1974).

The paper deals with the surface contribution to the critical current distribution in single-crystal vanadium rods subjected to different types of surface treatments. The field screen capacity as a function of the reduced magnetic induction, the critical current densities, and the near-surface layer thickness are discussed. (GE)

7037 (ARL/SM-348) FATIGUE OF STEEL STRUCTURES AND STRUCTURAL STEEL. Mann, J. Y. (Aeronautical Research Labs., Melbourne (Australia)). Mar 1974. 42p. Dep. NTIS (US Sales Only) $5.25.

Steel structures encompass a wide variety of end products and engineering design concepts and, in their construction, can embody steels ranging from mild steel to those of ultra-high static strength. However, the benefits which can accrue by the use of higher static strength steels may be nullified by their reduced fracture toughness and increased sensitivity to cyclic or repeated loads. After discussing the source and nature of fatigue loadings which can be experienced by structures, a brief resume is given of some basic concepts relating to the fatigue of steels, leading to fracture mechanics concepts in fatigue crack propagation. Reference is then made to the fatigue design requirements in various Codes and Specifications and, in particular, to the behavior of various types of welded and bolted joints under fatigue loading conditions. It is shown that, when relatively long fatigue lives are involved, the fatigue performance of a structure is dependent primarily on the detail design and configuration of the joints incorporated in its manufacture; the steels actually selected for the product have only a secondary influence on its behavior under repeated loads. In the case of low-cycle fatigue, or under conditions of high static mean stress, the choice of a high static tensile steel may, nevertheless, be well justified. A check-list is included of "Rules" which, if followed, provide a sound basis for good fatigue-design practice. (auth)

7038 (BNL-19460) EFFECT OF SURFACE ROUGHNESS ON POWER FREQUENCY LOSSES IN SUPERCONDUCTING Nb_3Sn AT 4.2°K. Bussiere, J. F.; Suenaga, M. (Brookhaven National Lab., Upton, N. Y. (USA)). 1974. 4p. (CONF-750439-1). Dep. NTIS $4.00.

From 13th international conference on magnetics; London, UK (14 Apr 1975).

The superconductivity of Nb_3Sn samples was measured on specimens having various different surface conditions. It was found that although reasonably smooth surfaces are essential to obtain large surface barrier fields DELTA H, other parameters such as pinning near the surface play a dominant role. (JRD)

7039 (CALT-822-67) STUDIES OF ALLOY STRUCTURES AND PROPERTIES. Annual Summary Report, 1 December 1973–1 December 1974. Duwez, P. (California Inst. of Tech., Pasadena (USA). Div. of Engineering). 1974. Contract AT(04-3)-822. 20p. Dep. NTIS $4.00.

Activities in research programs are reported on superconductivity in metal–semiconductor alloys, Ag–Pb alloys, metastable cubic alloys, Cu-rich V_3Si and V_3Ga composites, liquid quenched alloys, and transition metal alloys. Results of research are also included on Moessbauer effects in iron phosphides, properties of Pd–Cu–P systems, and amorphous alloys. (JRD)

7040 (CALT-822-69) ENHANCED SUPERCONDUCTIVITY AND LATTICE INSTABILITY IN Nb–Rh ALLOYS. Johnson, W. L.; Poon, S. J. (California Inst. of Tech., Pasadena (USA). W. M. Keck Lab. of Engineering Materials). Jan 1975. Contract AT(04-3)-822. 11p. Dep. NTIS $4.00.

Superconductivity with transition temperature above 10°K has been observed in a new Nb–Rh intermediate phase. The structure of this new phase is related to that of the sigma-phase but with higher symmetry. (auth)

7041 (CALT-822-72) PHENOMENOLOGICAL APPROACH TO HIGH TRANSITION TEMPERATURE SUPERCONDUCTING ALLOYS. Poon, S. J.; Johnson, W. L. (California Inst. of Tech., Pasadena (USA). W. M. Keck Lab. of Engineering Materials). Apr 1975. Contract AT(04-3)-822. 37p. Dep. NTIS $4.75.

Correlations between the observed maximum superconducting transition temperature T/sub c/ for a given binary alloys system and the alloy melting temperature T/sub m/ are pointed out. The stability of alloy phases favorable for high temperature superconductivity is discussed in terms of alloy phase diagrams. A comparison with the microscopic theory shows that the correlation between T/sub c/ and T/sub m/ can be interpreted in terms of the d-electron contribution to the cohesive energy of transition metal alloys as proposed by Barisic, Labbe, and Friedel [Phy. Rev. Lett. 25: 919(1970)]. The prospects for obtaining high T/sub c's are discussed in view of these results, and new alloy systems are suggested. (auth)

7042 (CEA-CONF-2747) USE OF SPECIAL SMOOTH TITANIUM TUBES IN CONDENSERS. Lauro, F. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Dept. de Transfert et Conversion d'Energie). 1973. 9p. (In French). INIS.

From 3rd meeting on titanium and its alloys; Nantes, France (17 May 1973).

The various tests undertaken on the application of titanium tubes to sea water desalination are described. This utilization mainly concerns the horizontal tube condenser working in a 20 to 120 deg C temperature range, and applies also to the condensers of electricity-generating stations. (FR)

7043 (CONF-741202-20) MAGNETIC SUSCEPTIBILITY MEASUREMENTS ON ACTINIDE–Be_{13} INTERMETALLIC COMPOUNDS. Brodsky, M. B.; Friddle, R. J. (Argonne National Lab., Ill. (USA)). 1974. Contract W-31-109-Eng-38. 10p. Dep. NTIS $4.00.

From 20th annual conference on magnetism and magnetic materials; San Francisco, California, USA (3 Dec 1974).

Magnetic susceptibilities were measured between 2 and 300°K for the compounds $AnBe_{13}$ (An equals Th, U, Np, Pu), all of which form the $NaZn_{13}$ structure. The susceptibility of $ThBe_{13}$ is temperature-independent. The data for UBe_{13} and $NpBe_{13}$ may follow two Curie–Weiss regions with the breaks occurring at 200 and 70°K respectively. The Curie–Weiss parameters are not substantially different for the two regimes, P,' ub eff/ equals 3.16 and 2.99 mu /sub B/ for UBe_{13}, and p/sub eff,' equals 2.35 and 2.76 mu /sub B/ for $NpBe_{13}$. For $PuBe_{13}$, the Curie–Weiss fit requires a temperature independent term and yields chi$_0$ equals 1.20×10^{-4} emu/g, p/sub eff/ equals 0.74 mu /sub B//Pu, and theta equals +11°K. The intermediate coupling scheme yields $5f^3$, $5f^4$, $5f^5$ configurations for the U, Np, and Pu compounds, respectively. Thus, each actinide ion is trivalent if the f-electrons are considered to be localized. Of these compounds, only $PuBe_{13}$ gives evidence for long-range magnetic order, becoming antiferromagnetic at T/sub N/ equals 11.5°K. (auth)

7044 (CONF-741202-21) FIELD-INDUCED TRANSITIONS IN DySb. Brun, T. O.; Lander, G. H.; Korty, F. W.; Kouvel, J. S. (Argonne National Lab., Ill. (USA)). 1974. Contract W-31-109-Eng-38. 10p. Dep. NTIS $4.00.

From 20th annual conference on magnetism and magnetic materials; San Francisco, California, USA (3 Dec 1974).

The NaCl-structured compound DySb, which in zero field transforms abruptly at T/sub N/ approximately 9.5°K to a Type-II antiferromagnetic (A) state with a nearly tetragonal lattice distortion, was previously found to exhibit rapid field-induced changes in magnetization at 1.5°K. The field-induced transitions in a DySb

crystal have been studied by neutron diffraction and magnetization measurements in fields up to approximately 60 kOe applied parallel to each of the principal axes. In the broken bracket 100 broken bracket case, the transition from the A to an intermediate ferrimagnetic (Q) state is first-order at 4.2^{0}K (critical field H/sub c/ approximately 21 kOe) but is continuous from approximately 6^{0}K up to T/sub N/, as H/sub c/ yields 0. The Q-to-paramagnetic (P) transition is rapid but continuous at 4.2^{0}K (H/sub c/ approximately 40 kOe) and becomes broad as T/sub N/ is approached. In the broken bracket 110 broken bracket case the A-to-Q transition remains essentially first-order from 4.2^{0}K (H/sub c/ approximately 15 kOe) up to T/sub N/; above T/sub N/ rapid P-to-Q transitions occur at very high fields. The magnetic structure of the Q state is found to be that of HoP. (auth)

7045 (CONF-741202-22) ROLE OF ITINERANT 5f STATES ON THE FERMI SURFACE OF Th AND POSSIBLE IMPURITY LOCAL MOMENT FORMATION. Koelling, D. D.; Freeman, A. J. (Argonne National Lab., Ill. (USA)). 1974. Contract W-31-109-Eng-38. 8p. Dep. NTIS $4.00.

From 20th annual conference on magnetism and magnetic materials; San Francisco, California USA (3 Dec 1974).

The nature (itinerant vs localized) of the 5f electrons in the actinides determines their magnetic properties. Extensive optical and de Haas–van Alphen data which exist only for Th, the simplest actinide with no occupied 5f states, allow detailed comparisons to be made between theory and experiment. The 5f bands were found, by means of ab initio RAPW energy band calculations, to lie above the Fermi energy, to be itinerant in character, and to significantly affect the reflectivity measurements of Veal, et al. [Phys. Rev. Letters; 30: 1061(1973)]. It is found that the 5f bands when included in the RAPW calculations, give excellent agreement with the de Haas–van Alphen results of Boyle and Gold [Phys. Rev. Letters; 22: 461(1969)], for all sections of the "lungs," "dumbbell," and "superegg" Fermi surfaces, in contrast with calculations based on artificially removing the 5f resonance. Simple overlap charge density impurity scattering potential model calculations are used to discuss the possible occurrence of impurity local moment formation in Th based alloys. (auth)

7046 (CONF-741202-23) MAGNETIC PROPERTIES OF URANIUM AND PLUTONIUM LAVES PHASES WITH 3d TRANSITION ELEMENTS. Lam, D. J.; Aldred, A. T. (Argonne National Lab., Ill. (USA)). 1974. Contract W-31-109-Eng-38. 7p. Dep. NTIS $4.00.

From 20th annual conference on magnetism and magnetic materials; San Francisco, California, USA (3 Dec 1974).

The magnetization of UMn_2, UFe_2, UCo_2, UNi_2, $PuMn_2$, $PuFe_2$, $PuCo_2$, and $PuNi_2$ from 4 to 300^{0}K in fields up to 14 kOe were measured. The susceptibility of UMn_2 shows a small maximum near 240^{0}K (which may indicate an antiferromagnetic transition) in agreement with previous results. The data for UFe_2, UCo_2, and UNi_2 are not in good agreement with earlier work; the ferromagnetic ordering temperature (158^{0}K) of a single crystal sample of UFe_2 is lower than any reported value, UNi_2 orders ferromagnetically at 30^{0}K, and UCo_2 may order below 5^{0}K. In contrast, $PuMn_2$, $PuCo_2$, and $PuNi_2$ have small weakly-temperature-dependent susceptibilities. $PuFe_2$ is ferromagnetic at room temperature, in agreement with previous Moessbauer results, and has a saturation moment of approximately 2.6 mu/sub B//mole. (auth)

7047 (CONF-741202-24) MAGNETIC AND LATTICE PROPERTIES OF CeBi. Lander, G. H.; Mueller, M. H.; Vogt, O. (Argonne National Lab., Ill. (USA)). 1974. Contract W-31-109-Eng-38. 9p. Dep. NTIS $4.00.

From 20th annual conference on magnetism and magnetic materials; San Francisco, California, USA (3 Dec 1974).

The magnetic structures of CeBi have been examined as a function of field with neutron diffraction. At low fields unusual domain reorientation effects are observed. For H greater than 18 kOe a 3+, 1– spin configuration is found. A first-order transition to induced ferromagnetic behavior occurs at 47.5 kOe. X-ray experiments at low temperature show that no lattice distortion occurs at either the Neel temperature or the I–IA transition at 12.5^{0}K. A volume discontinuity is observed at the low temperature transition. (auth)

7048 (CONF-741202-25) CALORIMETRIC EVIDENCE FOR LOCALIZED SPIN FLUCTUATIONS IN UAl_2. Trainor, R. J.; Brodsky, M. B.; Isaacs, L. L. (Argonne National Lab., Ill. (USA)). 1974. Contract W-31-109-Eng-38. 10p. Dep. NTIS $4.00.

From 20th annual conference on magnetism and magnetic materials; San Francisco, California, USA (3 Dec 1974).

Results of heat capacity measurements on UAl_2 between 1.8 and 400^{0}K are presented. The data are compared with recent resistivity and susceptibility measurements which indicate the existence of localized spin fluctuations in a narrow 5f band. Below about 50^{0}K the electronic contribution to the heat capacity becomes large, equivalent to gamma approximately 70 mJ/mole-K^2. Below 6^{0}K there is an upturn in C/T which is proportional to T^2 log (T/T/sub SF/), where T/sub SF/ equals 10.6^{0}K is identified as the spin fluctuation temperature. Extrapolation of this term to zero temperature yields m*/m yields 2 for the spin-fluctuation mass enhancement. At 300^{0}K, UAl_2 exhibits more typical metallic behavior, with gamma approximately 15 mJ/mole-K^2. Data are also presented for nonmagnetic URh_3; at low temperatures C equals gamma T + beta T^3, with gamma equals 14.5 mJ/mole-K^2 and beta corresponding to theta/sub D/ equals 336^{0}K. (auth)

7049 (HEDL-SA-748) MECHANICAL PROPERTIES OF ROLL EXTRUDED NUCLEAR REACTOR PIPING. Steichen, J. M.; Knecht, R. L. (Hanford Engineering Development Lab., Richland, Wash. (USA)). Jan 1975. Contract AT(45-1)-2170. 29p. Dep. NTIS $4.50.

The elevated temperature mechanical properties of large diameter (28 inches) seamless pipe produced by roll extrusion for use as primary piping for sodium coolant in the Fast Flux Facility (FFTF) have been characterized. The three heats of Type 316H stainless steel piping material used exhibited consistent mechanical properties and chemical compositions. Tensile and creep-rupture properties exceeded values on which the allowable stresses for ASME Code Case 1592 on Nuclear Components in Elevated Temperature Service were based. Tensile strength and ductility were essentially unchanged by aging in static sodium at 1050^{0}F for times to 10,000 hours. High strain rate tensile tests showed that tensile properties were insensitive to strain rate at temperatures to 900^{0}F and that for temperatures of 1050^{0}F and above both strength and ductility significantly increased with increasing strain rate. Fatigue-crack propagation properties were comparable to results obtained on plate material and no differences in crack propagation were found between axial and circumferential orientations. (auth)

7050 (IS-M-24) EXCHANGE INTERACTION IN THE HEAVY RARE-EARTH METALS CALCULATED FROM ENERGY BANDS. Lindgard, P. A.; Liu, S. H. (Iowa State Univ. of Science and Technology, Ames (USA)). 1973. 6p. (CONF-730821-7). Dep. NTIS $4.00.

From international conference on magnetism; Moscow, USSR (22 Aug 1973).

The exchange interaction in the ordered phases was calculated and found to be significantly influenced by the magnetic perturbation of the conduction electron states. The exchange interaction is intrinsically temperature dependent and is anisotropic. The effect explains how it is possible to have a spiral phase of Tb, although spin wave measurements show no maximum in J/sub q/ for q not equal to 0. The energy difference between the ferromagnetic and spiral phases is of correct order of magnitude to be counterbalanced by the magnetoelastic energy. The wave vector dependent matrix element is found to be similar for Gd, Tb, Dy, and Er with a narrow central conduction electron contribution and a flat region. (auth)

7051 (IS-M-33) TEMPERATURE INDEPENDENT ^{55}Mn MAGNETIC HYPERFINE FIELDS IN $ErMn_2$ AND $TmMn_2$. Barnes, R. G.; Lunde, B. K. (Ames Lab., Iowa (USA); Iowa State Univ. of Science and Technology, Ames (USA). Dept. of Physics). 1971. 10p. (CONF-741202-27). Dep. NTIS $4.00.

From 20th annual conference on magnetism and magnetic materials; San Francisco, California, USA (3 Dec 1974).

Analysis of the complex NMR spectra of ^{55}Mn in the hexagonal Laves phase compounds $ErMn_2$ and $TmMn_2$ reveals only a very slight temperature dependence of the ^{55}Mn Knight shift K at either of the two inequivalent lattice sites, in contrast to the Curie–Weiss behavior of the susceptibility of these compounds and their known ferromagnetic ordering properties. In addition, K differs negligibly from that in isostructural $ScMn_2$ which does not order magnetically. Both neutron diffraction and NMR data indicate that Mn carries no local moment, and the Knight shift measurements suggest that K results essentially entirely from the orbital contribution, K(orb). Unlike the case of the $LnAl_2$ cubic Laves phase compounds, for example, the net contribution of K resulting from indirect interaction between ^{55}Mn and the rare-earth moments is relatively small. (auth)

7052 (KFK-2136) SYSTEMATIC ERRORS IN AREAL ANALYSIS USING A COMBINATION OF EPIDIASCOPE AND IMAGE ANALYSER. Schulz, B.; Biel, J. Translated from Prakt. Metallogr.; 12: No. 1, 18-24(Jan 1975). 7p. (In German, English). INIS.

Investigation of systematic errors in the measurement of porosity using a combination of epidiascope and image analyser has shown that it is possible to determine the true pore fraction accurately if a "soft" grade of paper is used and if the screen magnification is so high that the pores in the lowest size class

in the size spectrum are magnified to about 4 × the line width. (auth)

7053 (LA-5943-MS) ONE-DIMENSIONAL CALCULATIONS OF SHOCK-LOADED POLYCRYSTALLINE BERYLLIUM. Swanson, R. E. (Los Alamos Scientific Lab., N. Mex. (USA)). Apr 1975. Contract W-7405-eng-36. 9p. Dep. NTIS $4.00.

A numerical study of the response of polycrystalline beryllium to shock loading is described. Various methods of incorporating material properties relations to improve the hydrodynamic calculations are discussed and a treatment whereby the anisotropic, polycrystalline nature of beryllium can be modeled is proposed. Results of calculations are presented and compared with experimental data of several investigators. The applicability of the treatment is evaluated. (auth)

7054 (LBL-3742) AUGER ELECTRON SPECTROSCOPY OF ALLOY SURFACES. Overbury, S. H.; Somorjai, G. A. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Mar 1975. Contract W-7405-ENG-48. 25p. (CONF-750702-1). Dep. NTIS $4.25.

From conference of the Faraday Society on electron spectroscopy of solids and surfaces; Vancouver, B. C., Canada (15 Jul 1975).

Regular solution models are used to predict surface segregation of the constituent of lowest surface free energy in homogeneous multicomponent systems. Analysis of the Auger electron emission intensities from alloys yield the surface composition and the depth distribution of the composition near the surface. Auger Electron Spectroscopy (AES) studies of the surface composition of the Ag–Au and Pb–In systems have been carried out as a function of bulk composition and temperature. Although these alloys have very different regular solution parameters their surface compositions are predictable by the regular solution models. (auth)

7055 (ORNL-TM-4800) MEASUREMENT OF FLAW SIZE IN A WELD SAMPLE BY ULTRASONIC FREQUENCY ANALYSIS. Whaley, H. L. Jr.; Adler, L.; Cook, K. V.; McClung, R. W. (Oak Ridge National Lab., Tenn. (USA)). May 1975. Contract W-7405-eng-26. 26p. Dep. NTIS $4.50.

An ultrasonic frequency analysis technique has been developed and applied to the measurement of flaws in an 8-in.-thick heavy-section steel specimen belonging to the Pressure Vessel Research Committee program. Using the technique the flaws occurring in the weld area were characterized in quantitative terms of both dimension and orientation. Several modifications of the technique were made during the study to include the application of several transducers and to consider ultrasonic mode conversion. (auth)

7056 (ORNL-tr-2985) EFFECT OF HEAT PROCESSING ON HEAT CONDUCTION AND ELECTRICAL CONDUCTION IN STEEL 15Kh12BMF (EI802). Krzhizhanovskii, R. E. Translated by Martha Gerrard from Metalloved. Term. Obrab. Metal.; No. 2, 48–49(1962). 3p. Dep. NTIS $4.00.

Results of studies on the effects of temperature of hardening and tempering and time of aging of steel at 550 and 600°C on thermoconductivity, electroconductivity, and value of alpha for steel EI 802 are presented. It was found that the heat conductivity of steel EI 802 depends more on the structure than does the electrical conductivity. (auth)

7057 RD/B/N-3236) FATIGUE BEHAVIOR OF ANNEALED AISI 316 STAINLESS STEEL IN AIR AND HIGH TEMPERATURE SODIUM: REVIEW AND PRELIMINARY RESULTS. Marshall, P. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Nov 1974. 19p. Dep. NTIS (US Sales Only) $4.00.

Techniques for measuring fatigue damage in sodium at elevated temperatures have been developed and tested. Short-term tests have demonstrated that low oxygen sodium reduces fatigue crack growth and increases fatigue endurance of annealed AISI 316 stainless steel when compared with similar tests in air. Exclusion of air and moisture from the specimen is thought to account for the improvement of properties in the sodium environment. The results are discussed and compared with recent American fatigue data in air and sodium. (auth)

7058 (RDT-M-7-1T(4-75)) MARTENSITIC STAINLESS STEEL (TYPE 403) BARS (ASTM A 276 WITH ADDITIONAL REQUIREMENTS). (Energy Research And Development Administration, Washington, D. C. (USA). Div. of Reactor Research and Development). Apr 1975. 12p. RSO.

A standard prescribing requirements for martensitic stainless steel (type 403) bars (ASTM A 276 with additional requirements) for nuclear and associated applications is presented. This standard supersedes RDT M 7-1T, dated July 1971. (JRD)

7059 (SAND-75-8502) TRITIUM DIFFUSIVITY AND SOLUBILITY MEASUREMENTS IN Z 5 NCTD 26-15 (A 286) AUSTENITIC STAINLESS STEEL. Broudeur, R.; Fidelle, J. P.; Devaux, J.; Rapin, M. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 92 – Montrouge (France)). Jan 1975. Translation by Patricia Newman of Mesures de Diffusivite et de Solubilite du Tritium Dans un Acier Inoxydable Austenique Z 5 NCTD 26-15. (CONF-720571-1). 22p. Dep. NTIS $4.25.

From international congress on hydrogen in metals conference; Paris, France (29 May 1972).

A method of calculation that allows the diffusion coefficient and solubility of a gas in a metal to be expressed by analysis of its entry kinetics during a metal charging test under given temperature and pressure is cited. This method is applied to tritium charging of Z 5 NCTD 26-15 (A 286) austenitic stainless steel. The special equipment necessary for such tests is described. The diffusion coefficient and solubility of tritium in this steel are determined in tests made between 350 and 450°C under a pressure of 10 bars. (auth)

7060 (TID/SNA-2057) MATERIALS DATA RELEASE MEMORANDA. (Aerojet-General Corp., Sacramento, Calif. (USA)). 1972. 225p. Dep. NTIS $14.25.

Data on properties of reactor structural materials are presented. Data sheets are included on Inconel 718, 347 stainless steel, Ti-base alloys, alloy A-286, Al-base alloys, Hastelloy x, 301 stainless steel, 310 stainless steel, 9390 steel, and 22-13-5 stainless steel. (JRD)

7061 (TID/SNA-2059) METALLOGRAPHY OF AISI 347 SHEET (.016") CREEP TESTED IN GH_2 AT BATTELLE. (Anamet Labs., Inc., Berkeley, Calif. (USA)). 22 Oct 1970. 20p. Dep. NTIS $4.00.

For Aerojet Nuclear Systems Co., Sacramento, CA.

Photomicrographs are presented of 16 type 347 stainless steel flat 0.016-in. thick creep rupture specimens. Data on time, temperature and pressure of creep testing are listed with each micrograph. (JRD)

7062 (TID/SNA-2081) EVALUATION OF THE LOW-CYCLE FATIGUE RESISTANCE OF 347 STAINLESS STEEL AT 1000°F. (New York State Office of Economic Research, Albany (USA)). Jul 1971. 31p. Dep. NTIS $4.75.

For Aerojet Nuclear Systems Co., Sacramento, CA.

Strain-controlled low-cycle fatigue tests were performed in air at 1000°F to evaluate the fatigue resistance of 347 stainless steel using compression-compression strain cycling. Four tests were performed at a total axial strain range of 1.5%; two of these tests employed an axial R-ratio on strain of minus unity (completely reversed strain cycling) while two other tests involved an axial R-ratio on strain of minus infinity (compression-compression strain cycling). At the test conditions involved the fatigue life was found to be essentially independent of the R-ratio. (auth)

7063 (TID/SNA-2114) FATIGUE TESTS OF WELDED 6061-T6 ALUMINUM AT LIQUID HYDROGEN TEMPERATURE. Yamahara, S.; Flora, E.; Hunnicutt, R. (Anamet Labs., Inc., Berkeley, Calif. (USA)). 8 Feb 1971. 19p. Dep. NTIS $4.00.

For Aerojet Nuclear Systems Co., Sacramento, CA.

The specimens were 0.160-in. thick. Results are tabulated and presented in plots showing stress level vs. cycles to failure. (JRD)

7064 (TID/SNA-2124) FLEXURE FATIGUE TESTS OF Ti–5Al–2.5Sn At –423°F. Adsit, N. R. (General Dynamics Corp., Fort Worth, Tex. (USA). Convair Aerospace Div.). Jul 1971. 14p. Dep. NTIS $4.00.

For Aerojet Nuclear Systems Co., Sacramento, CA.

Flexural fatigue specimens of Titanium–5% Al, 2.5% Sn ELI grade were tested in a BLH SFI-U fatigue testing machine at cryogenic conditions. S-N diagrams are given and show a difference in forgings prepared by different companies. There was considerable scatter in the data and, due to limited funding, the sampling was not sufficient to adequately define fatigue properties. No comparative data was found. (LTN)

7065 (TID/SNA-2125) SHARP NOTCH TENSION FRACTURE TOUGHNESS EVALUATION OF WELDED 6061-T6 ALUMINUM ALLOY SHEET AT –423°F. Kropp, C. J. (General Dynamics Corp., Fort Worth, Tex. (USA). Convair Aerospace Div.). Jun 1971. 15p. Dep. NTIS $4.00.

For Aerojet Nuclear Systems Co., Sacramento, CA.

The sharp notch tension fracture toughness of welded 6061-T6 aluminium alloy sheet was determined at –423°F. The notch was located in a weld bead transverse to the specimen length. Fatigue precracking was performed at room temperature. Crack growth was then determined under stress at cryogenic

temperatures. From the results, the plane stress critical stress intensity factor was calculated by formulae which are given. (LTN)

7066 (UH-235P12X1) PRESSURE DERIVATIVES OF ELASTIC MODULI IN BCC TRANSITION METALS AND THEIR SOLID SOLUTIONS. Progress Report for the First Year, 1 June 1974–20 April 1975. (USAEC San Francisco Operations Office, Calif.). 1975. 11p. Dep. NTIS $4.00.

Activities in research programs are reported on pressure derivatives of elastic moduli in Nb–Mo alloys and in Ta. Data on second order adiabatic elastic moduli and their pressure derivatives in these alloys and in Ta are tabulated. Data are also presented and discussed on the electron-to-atom ratio relations with density and moduli for Nb–Mo alloys. (JRD)

7067 (Y-1967) THERMOPHYSICAL PROPERTIES OF A TYPE 308 STAINLESS STEEL WELD. Lore, J. D.; Richards, H. L.; King, R. T.; Greene, L. M.; Darby, D. M. (Oak Ridge Y-12 Plant, Tenn. (USA)). 30 Apr 1975. Contract W-7405-eng-26. 51p. Dep. NTIS $5.45.

Thermal expansion, thermal diffusivity, specific heat, and thermal conductivity measurements were obtained in vacuo for a Type 304-308 stainless steel weldment for use in the Liquid Metal Fast Breeder Reactor. Property measurements were somewhat variant, depending upon the direction of measurement, but the observed differences were small. (auth)

7068 TERMICHESKAYA OBRABOTKA TUGOPLAVKIKH, REDKIKH METALLOV I IKH SPLAVOV. (Thermal Processing of Refractory and Rare Metals and Their Alloys). Mal'tsev, M. V. Moscow; Metallurgiya (1974). 343p.

The basic forms of thermal processing of important industrial refractory and rare metals and their alloys (annealing, recrystallization, quenching, and aging) are examined. Some singularities in carrying out these processes and the equipment used are also discussed. Among the elements discussed are W, Mo, Nb, Re, Ti, Cr, V, Zr, and Ta and their alloys. (JSR)

7069 CARRIER MOBILITY AND INFRARED ABSORPTION IN In-DOPED CdSb. Gertovich, T. S.; Grineva, S. I.; Semizorov, A. F.; Rarenko, I. M.; Tovstyuk, K. D. (Chernovtsy State Univ., USSR). Inorg. Mater.; 10: No. 10, 1612-1614(Oct 1974).

Translated from Izv. Akad. Nauk SSSR, Neorg. Mater.; 10: No. 10, 1879-1881(Oct 1974).

Measurements of the optical absorption in the long-wave region and in the fundamental band region were made in parallel with the electrical conductivity and Hall effect, on CdSb specimens, with various concentrations of In, at 295 and 90°K, with the aim of studying the mechanisms of scattering and the role of impurities in CdSb. The spectral dependence of the coefficient of absorption (α) for pure and doped specimens was investigated in the range 0.6 to 0.08 eV (1.8 to 17 μ). Based on the ionization energy of the In impurity level and its concentration and temperature dependencies in CdSb, it is concluded that electrons undergo transition from an acceptor level to the conductivity zone and holes undergo transition from an acceptor level to the valence zone. (JRD)

7070 PHASE DIAGRAM OF THE SYSTEM AuIn–Sb. Nikitina, V. K.; Lobanova, Yu. K. (Inst. of General and Inorganic Chemistry, Moscow). Inorg. Mater.; 10: No. 9, 1376-1378(Sep 1974).

Translated from Izv. Akad. Nauk SSSR, Neorg. Mater.; 10: No. 9, 1596-1599(Sep 1974).

Using physicochemical analysis methods, the reaction of AuIn with antimony was investigated. It was established that this cross section is quasi-binary and that the initial components form mechanical mixtures with limited solubility. The eutectic point is located at the composition containing ~28 at.% Sb at 421°C. The solubility of Sb in AuIn at the eutectic temperature is somewhat greater than 10 at.%; at room temperature it decreases to ~7 at.%. The solubility of AuIn in Sb at equilibrium reaches 5 mole %. (auth)

7071 PHASE TRANSITIONS IN THIN FILMS OBTAINED BY DECOMPOSITION OF RHENIUM CARBONYL. Osipov, K. A.; Galkin, B. D.; Ukrainskii, Yu. M.; Urazaliev, U. S. (Inst. of Metallurgy, Moscow). Inorg. Mater.; 10: No. 9, 1370-1372(Sep 1974).

Translated from Izv. Akad. Nauk SSSR, Neorg. Mater.; 10: No. 9, 1590-1592(Sep 1974).

The crystal structure and phase transitions were investigated in thin films obtained by high-temperature decomposition of $Re_2(CO)_{10}$. It was found that these films contain two phases. When the films are subjected to heat treatment in the high-temperature attachment of a diffractometer (1000°C, ~10^{-3} mm) or in an electron-diffraction camera (900°C, duration of heat treatment 10 min, vacuum ~10^{-5} mm), they consist of pure Re. (auth)

7072 THE PRECISE STRUCTURAL ANALYSIS OF CRYSTALS BY T–O–F NEUTRON DIFFRACTION. Takahashi, J.; Harada, J. (Nagoya Univ. (Japan). Faculty of Engineering); Niimura, N. Kakuriken Kenkyu Hokoku; 7: No. 1, 129-135(Jun 1974). (In Japanese).

The measurement of the wavelength distribution i(λ) of incident neutrons is one of important items in case of the structural analysis of single crystals by T–O–F method. It is one fault that insensitive time up to about 150 channels appears due to the γ-burst at the time of the measurement of direct beam at $2\theta = 0^0$. Measurement was carried out at $2\theta = 90^0$ with the vanadium cylindrical bar of 10 mm$^{\phi}$. The direct beam was observed at $2\theta = 0^0$, using a lead block with a hole as a slit to remove the insensitive time due to γ-burst. The measurement by reducing linac intensity was carried out to examine the shift of the peak of i(λ). It was shown from the data that the insensitive time due to the γ-burst disappeared when a lead slit was used. Therefore, it may not be required to measure i(λ) of a vanadium sample which requires various correction in usual cases. The measurement of i(λ) in case of Bragg reflection is not correct because of unclear points of TDS at lower channels, and of extinction at higher channels. The problem of extinction may be solved to some extent by the reference measurement of powdered crystal of CuCl. The more precise analysis of single crystal structure by TOF method will require further improvement in the experiment. (JA)

7073 METHOD OF INVESTIGATING THE ENDURANCE OF SMOOTH AND NOTCHED SPECIMENS OF COMMERCIAL Mo AT ROOM AND HIGH TEMPERATURES. Gryaznov, B. A.; Shemegan, Yu. M.; Rovkov, V. A.; Zelenyuk, E. E. (Inst. of Strength of Materials, Kiev). Strength Mater.; 6: No. 7, 832-835(Jul 1974).

Translated from Probl. Prochnosti; 6: No. 7, 48-51(Jul 1974).

Results of fatigue tests of Mo sheets coated with MoB and $MoSi_2$ layers at 20, 900, 1300, and 1500°C are presented. Results are discussed and presented in plots showing temperature distribution in the fatigue specimens, endurance of specimens, and fracture modes. (JRD)

7074 KINETICS OF ISOTHERMAL SOFTENING OF W AT 900°C. Zasimchuk, E. E.; Sviridovskii, Yu. M. (Inst. of Problems in Strength, Kiev). Strength Mater.; 6: No. 7, 845-846 (Jul 1974).

Translated from Probl. Prochnosti; 6: No. 7, 61-62(Jul 1974).

Mechanisms of polycrystalline W wire softening in deformation by drawing at temperatures below 300°C were investigated. It was found that annealed W wire is softened with a simultaneous rise in plasticity due to the absence of recrystallization. The plasticity characteristics are also associated with annihilation of chaotically distributed dislocations. (JRD)

7075 HARDENING OF Mo BY MICROADDITIONS OF Hf AND HfC. Malashenko, I. S.; Kashtalyan, Yu. A.; Vashchilo, N. P.; Naumenko, V. Ya.; Vasil'ev, A. D. Strength Mater.; 6: No. 7, 850-855(Jul 1974).

Translated from Probl. Prochnosti; 6: No. 7, 66-71(Jul 1974).

Results of studies of the microstructure and physicomechanical properties of cast and heat-treated Mo–Hf and Mo–Hfc bars are presented. An analysis of the temperature dependence of the normal elasticity modulus of recrystallized alloys shows that Mo–HfC alloys have a higher structural stability above 1000°C than unalloyed molybdenum. The heat-resistance level increases in comparison with molybdenum as the testing temperature is increased. Heterogenization of the structure reduces the effective elasticity constants at moderate temperatures and at the same time decelerates relaxation phenomena especially at the polycrystalline aggregate boundaries. It is concluded that micro-alloying electron-beam melted molybdenum with hafnium carbide improves the low-temperature plasticity of cast and recrystallized molybdenum and at the same time increases its heat resistance whose level depends on the amount of second phase added and on the heat treatment properties. (auth)

7076 EFFECT OF CRYSTALLIZATION FACTORS ON THE STRENGTH OF CAST Ni ALLOYS. Zhukov, N. D.; Lashko, N. F.; Belyaev, M. S. (Inst. of All-Union Scientific-Research of the Behavior of Metals Used in Aviation, Moscow). Strength Mater.; 6: No. 7, 883-889(Jul 1974).

Translated from Probl. Prochnosti; 6: No. 7, 99-105(Jul 1974).

Factors which reduce the failure resistance of cast Ni–base alloys to cyclic variable loads were studied. It was concluded that the main factors responsible for strength reduction in these alloys are coarse dendritic structure and large grain size. Improvement of strength, plasticity, and fatigue strength of the alloys is achieved by the processes of directed crystallization. (JRD)

7077 INVESTIGATION OF THE BENDING FATIGUE STRENGTH OF CERTAIN ALLOYS WITH STRESS CONCENTRATION. Troshchenko, V. T.; Getman, A. F. (Inst. of Problems in the Strength of Materials, Kiev). Strength Mater.; 6: No. 7, 798-804(Jul 1974).

Translated from Probl. Prochnosti; 6: No. 7, 14-20(Jul 1974).

The effect of the type of loading (tensile–compressive or bending) and stress raisers on the fatigue strength of metals at room and high temperatures were investigated along with the basic factors affecting these trends. Most attention was paid to the effect of cyclic elastoplastic strain on the stressed state of specimens with stress raisers, the effect of the mechanical state of the surface layer on the material's sensitivity to stress concentration, and the effect of the nonuniformity and type of the stressed state on the ultimate strength at room and high temperatures. Results of maximum strain tests are tabulated. Data on the effects of stress gradient on the fatigue limit of polished specimens are presented in plots along with data on the ratio of fatigue limit of materials in a nonuniform stressed state to the fatigue limit under tensile–compressive loads. (JRD)

7078 UNIQUE INTERMETALLICS COMBAT WEAR AND CORROSION. Met. Prog.; 107: No. 5, 90-92(May 1975).

Properties of Tribaloy materials are reviewed. Examination of these materials shows that both high-temperature wear and corrosion resistance are provided by dispersing a hard intermetallic phase in a softer cobalt or nickel-base alloy matrix. The materials are supplied as powders which can be plasma sprayed or hot isostatically pressed into 99.5 percent dense parts. Most grades can be shell mold or investment cast; and Tribaloy welding rods are available for hardfacing applications. Tribaloy powders can also be blended with other powders, such as nickel or Monel. The blend can then be plasma sprayed or compacted by conventional P/M techniques. (JRD)

7079 FIELD ION MICROSCOPIC STUDY OF FILMS OF MOLYBDENUM, PLATINUM, AND TANTALUM VAPOR DEPOSITED ON TUNGSTEN. Boateng, A. Columbus, OH; Ohio State Univ. (1974). 171p. University Microfilms Order No. 75-11,317.

Thesis (Ph. D.).

The relationships between the physical properties and structure of thin films of metals and other materials have been the subject of extensive study because thin films are used in a variety of technological applications, e.g., in integrated electronic circuits; also the results from these studies can be used to test certain physical metallurgy theories. A Type 304 stainless steel Field Ion Microscope (FIM) was built and used to study films of Mo, Pt, and Ta vapor deposited on W emitter substrates. The microscope was provided with a channel plate image intensifier and there was provision for complete coverage of the emitter substrate by the incident vapor. The imaging gas was helium and the microscope was operated at 78°K. The studies of Mo films were done on bicrystalline as well as monocrystalline W substrates. Mo films prepared at 78°K were initially pseudomorphic and several layers thick before the onset of nucleation and growth of Mo crystallites. On heated W tips (T gt 300°K) the Mo deposit had two continuous growth layers. The layer nearest the W interface was perfectly epitaxial whereas the top layer was polycrystalline. In the polycrystalline layer the mismatch between crystals was always near the brace 011 brace zone lines. Annealing Mo films prepared at 78°K at elevated temperatures (approximately 1200°K) for a few seconds transformed the pseudomorphic and polycrystalline layers into an epitaxial single crystal (or bicrystal depending on the nature of the substrate) film which displayed the Mo contrast. Shorter annealing times were used to obtain partially transformed deposits. These also had a duplex structure similar to those obtained by deposition on heated tips; the layer nearest the W substrate was epitaxial and single crystalline, on top of which lay a polycrystalline layer. This is the first time that such an observation has been made on FIM specimens and a mechanism for the phase transformation was proposed. There was a clearly defined interface between all epitaxial films and the W substrate; the Mo film was crystalline right up to the W interface and the characteristic Mo contrast was displayed even by the last monolayer of Mo to be removed. Mo deposits formed at 78°K in poor vacuum (approximately 10^{-4} torr) were not stable; there was no evidence of abnormal structures such as the fcc modification. On heated tips and in vacuums of 10^{-5} to 10^{-6} torr the deposit was epitaxial (though imperfect). Pt deposits were not stable to the imaging process (helium gas, 78°K) and most of the deposit was always prematurely field desorbed. For films prepared at 78 to 850°K, following the premature field desorption, there was a strongly adsorbed monolayer of pseudomorphic Pt left on the W; this last monolayer was so strongly bound to the W substrate that it usually displayed the brace 100 brace zone line decoration which is a characteristic of W tips. Excessive substrate temperatures weakened the bonding possibly due to alloying through interdiffusion. Ta films were crystalline but very poorly ordered. When subjected to high temperature there was only a marginal improvement in order. The first monolayer of Ta on the W substrate was also disordered. (Diss Abstr. Int., B)

7080 INTERSTITIAL RELAXATIONS DUE TO HYDROSTATIC STRESS IN NIOBIUM–OXYGEN ALLOYS. Tewari, S. N. Lafayette, IN; Purdue Univ. (1974). 153p. University Microfilms Order No. 75-10,970.

Thesis. (Ph. D.)

Experimental investigations of the anelastic relaxation induced by hydrostatic stress in the range from ambient to 81 ksi were made for niobium–oxygen alloys. The anelastic responses, both for the pressurization and the pressure release experiments, were followed by measuring the relative length change between the oxygenated niobium sample and a pure niobium frame with a precision of about 2 A. The relaxation spectrum observed was shown to be made up of three distinct relaxations with unique relaxation times and strengths. The pressure dependence of the relaxation times gave the apparent activation volume for these relaxations of the order of 4 cm^3 mole. The relaxations were observed to have relaxation strengths of the order of 10^{-4} which were found to be independent of pressure up to 81 ksi. The relaxation times for these relaxations were found to occur in the same general temperature range as those for the Snoek relaxations of oxygen clusters in niobium. The temperature dependence of the relaxation times, however, gave activation energies of about 11 to 15 kcal/mole, as compared with roughly 27 to 29 kcal/mole for the Snoek relaxation of oxygen clusters in niobium. Several possible models for these relaxations were developed, however, none could predict the observed temperature dependence. The best interpretations of the data is that due to some anomalous competing relaxation the actual temperature dependence of these relaxations could not be observed. A completely self-consistent analysis is found which is based upon this assumption. The relaxation times and strengths were found to be in good agreement with the predictions based upon models involving interstitial oxygen clustering reactions (for two relaxations with the fastest and the intermediate relaxation times) and oxygen-substitutional impurity trapping reactions (for the slowest relaxation). The observed reaction distances for the three relaxations were also found to agree reasonably well with those estimated from the expected concentrations of the reacting species. (Diss. Abstr. Int., B)

7081 CRYSTAL STRUCTURE OF STOICHIOMETRIC $CoIn_2$ INTERMETALLIC COMPOUND IN BINARY COBALT—INDIUM SYSTEM. Manaktala, H. K. Raleigh, NC; North Carolina State Univ. (1974). 110p. University Microfilms Order No. 75-10,412.

Thesis (Ph. D.)

The compound $CoIn_2$ was prepared by reacting solid cobalt with liquid indium for 210 hours at 500°C followed by quenching in water at room temperature. Its crystal structure has been determined by single-crystal x-ray diffraction analysis (diffractometer method) using monochromatized MoK alpha radiation. $CoIn_2$ crystallizes in orthorhombic system, space group Fddd, D^{24}/sub 2h/,#70. The unit cell, which contains 48 atoms, has the dimensions: a equals 9.402 +- 0.013, b equals 17.846 +- 0.011, and c equals 5.282 +- 0.006 A. These final cell parameters were determined from the x-ray powder diffraction data. X-ray density was determined as 8.65 g cm^{-3} and cell volume V equals 885.3 A^3. The structure was refined by the least squares method using positional parameters and anisotropic temperature factors. Final value of R obtained was 0.068. The crystal structure, based on hexagonal nets and square antiprisms, is related to $CuMg_2$ structure type. Atomic coordinates and bond lengths, furnished by the refined structural parameters, were tested against a mathematically rigorous structure model based on hard sphere contact. The model assumes spherical packing of all atoms of only two diameters and has axial ratios a/b equals 1/2, and c/b equals 1/2 radical 3 and a packing density of 0.68. The agreement with the model is good; the distortions in the observed structure are attributed to preferential Co--In bonds. Bonding in the other known representatives of the $CuMg_2$ type is also investigated. (Diss. Abstr. Int., B)

7082 OBSERVATION OF OXIDE PARTICLES BELOW THE APPARENT OXYGEN SOLUBILITY LIMIT IN TANTALUM. Stecura, S. Metall. Trans.; 5: No. 6, 1337-1340(Jun 1974).

The apparent solubility of O in polycrystalline Ta as determined by the x-ray diffraction lattice parameter technique is approximately 1.63 at. percent at 820°C. However, oxide particles were identified in samples containing as low as 0.5 at. percent O. These particles were present at the grain boundaries and within the grains. The number of oxide particles increased with increasing O concentration in Ta. The presence of oxide particles suggests that the true solubility in the polycrystalline Ta metal is probably lower than that reported in the literature. (Metals Abstr.)

7083 DESIGN OF STRONG TOUGH Fe/Mo/C MARTENSITIC STEELS AND THE EFFECTS OF COBALT. Clark, R. A.; Thomas, G. (Univ. of California, Berkeley). Metall. Trans.; 6A: No. 5, 969-979(May 1975).

The microstructures and mechanical properties of a series of vacuum melted Fe/(2 to 4) Mo/(0.2 to 0.4) C steels with and without cobalt have been investigated in the as-quenched fully martensitic condition and after quenching and tempering for 1 hr at 673 and 873°K; austenitizing was done at 1473°K in argon. Good strength and toughness properties were obtained with the Fe/2 Mo/0.4 C alloy in the as-quenched martensitic condition and this is attributed mainly to the absence of internal twinning. The slightly inferior toughness properties compared with Fe/Cr/C steels is attributed to the absence of interlath retained austenite. The two 0.4 percent carbon steels having low Mo contents had approximately one-half the amount of transformation twinning associated with the two 0.4 percent carbon steels having high Mo contents. The plane strain fracture toughness of the steels with less twinning was markedly superior to the toughness of those steels with similar alloy chemistry which had more heavily twinned microstructures. Experiments showed that additions of Co to a given Fe/Mo/C steel raised M/sub s/ but did not decrease twinning nor improve toughness. Molybdenum carbide particles were found in all specimens tempered at 673°K. The Fe/Mo/C system exhibits secondary hardening after tempering at 873°K. The secondary hardening is associated with a reduction in toughness. Additions of Co to Fe/Mo/C steels inhibited or eliminated the secondary hardening effect normally observed. Toughness, however, did not improve and in fact decreased with Co additions. (auth)

7084 SMALL-ANGLE X-RAY SCATTERING INVESTIGATION OF THE ZONE FORMATION OF MARAGING TYPE ALLOYS. Servant, C. (CEN de Saclay, Gif-sur-Yvette, France); Maeder, G.; Cizeron, G. Metall. Trans.; 6A: No. 5, 981-990(May 1975).

The small angle x-ray scattering from maraging type alloys previously aged at temperatures below 450°C has been studied at room temperature. The behavior, during aging, of two high purity alloys containing Fe, Ni, Co, and Fe, Ni, Co, and Mo is compared with an industrial Vascomax 300 type steel. The existence of G.P. zones is pointed out for the two Mo containing alloys. In the case of the quaternary alloy, the evolution of these zones during the aging is clearly defined. For the industrial steel, the interpretation of the observed phenomena is more complex due to the additional small amounts of Ti, Cu, and Al and is discussed. (auth)

7085 SIMS ANALYSIS OF DOPED TUNGSTEN. Pebler, A.; Sweeney, G. G.; Castle, P. M. (Westinghouse Research Labs., Pittsburgh). Metall. Trans.; 6A: No. 5, 991-996(May 1975).

Tungsten filaments derive their unique high temperature creep resistance and strength from the addition of small amounts of K, Al, and Si, which are added to WO_3 prior to its reduction with hydrogen. A direct imaging secondary ion mass spectrometer was used in the identification of potassium-filled voids in annealed tungsten. The capabilities of the instrument are further explored. Preparation of specimens that include annealed rods and 65 mu m dia lamp filaments is described. Ion images show the distribution of the dopant elements at various annealing stages. Ion sputtering of K-filled voids yields secondary ion bursts that are used to measure their number density in annealed tungsten. The redeposition of tungsten in burned regenerative cycle lamps was studied using the instrument. (auth)

7086 SOLID STATE PORTION OF THE Hf–Ta PHASE DIAGRAM. Krug, M. P.; Oden, L. L.; Romans, P. A. (Bureau of Mines, Albany, OR). Metall. Trans.; 6A: No. 5, 997-1002(May 1975).

The solid state reactions in the Hf–Ta system were investigated by high-temperature x-ray diffraction, differential thermal analysis, and electron probe microanalysis. The results support a phase diagram with a monotectoid at about 40 at. percent Ta and an isotherm at 1083°C. A small miscibility gap was observed between about 40 and 80 at. percent Ta with a maximum temperature of about 1150°C. (auth)

7087 VALANCE FLUCTUATIONS ON RARE EARTH IONS. Sales, B. C. San Diego, CA: Univ. of California (1974). 114p. University Microfilms Order No. 75-9488.

Thesis (Ph. D.).

The magnetic, electrical, and thermodynamic properties of several metallic rare earth compounds with anomalous lattice constants such as YbC_2, $YbAl_3$, $YbAl_2$, YbB_4, $YbCu_2Si_2$, CeB_4, CeN, $CeCu_2Si_2$, and $EuCu_2Si_2$ are examined. Though diverse in composition and crystal structure, these compounds exhibit qualitatively similar anomalies in their electronic properties. Apart from an "abnormal" lattice constant, they show a large paramagnetic susceptibility (sometimes with Curie-Weiss behavior at high temperatures), yet there is no evidence of magnetic order. The low temperature magnetization curves (M vs. H) are linear and do not saturate in the region where mu H much more than k/sub B/T, as is expected for non-interacting rare earth ions. The resistivity curves exhibit large departures from a simple T law, indicating a large magnetic scattering contribution. The electronic specific heat coefficient and the thermopower are large, suggesting a large density of states at the Fermi level. The experimental data are found to be in good agreement with what is expected qualitatively from fluctuations of the rare earth ion shell between two integral valence states. (Diss. Abstr. Int., B)

7088 ZIRCONIUM–ALUMINUM ALLOY AS A GETTER FOR HIGH INTENSITY DISCHARGE LAMPS. Barosi, A.; Rabusin, E. (SAES Getters S.p.A., Milan). Jap. J. Appl. Phys.; No. Suppl. 2, 49-52(1974).

From 6th international vacuum congress; Kyoto, Japan (25 Mar 1974). See CONF-740353-.

Gaseous impurities within lamp envelopes strongly influence their life and performance. High pressure discharge lamps are particularly sensitive to impurities, especially hydrogen which permeates into the burner increasing the striking voltage. A Zr–Al alloy (16% by weight Al) is presented as the most suitable getter for hydrogen, and other noxious gases, in both evacuated and gas filled envelopes. Its behavior in the simulated operation conditions of various lamp types is described. Sorption performance of the Zr–Al getter when activated or not activated, as a function of operating temperature and other parameters is illustrated. (auth)

7089 MEASUREMENT OF THERMAL ACCOMMODATION COEFFICIENTS OF NOBLE GASES ON TUNGSTEN WITH DIFFERENT SURFACE STRUCTURES BETWEEN 300 AND 370 K. Bierhals, J.; Grosse, G.; Messer, G. (Physische-Technische Bundesanstalt, Brunswick). Jap. J. Appl. Phys.; No. Suppl. 2, 335-338 (1974).

From 6th international vacuum congress; Kyoto, Japan (25 Mar 1974). See CONF-740353-.

Thermal accommodation coefficients (a.c.) of noble gases on clean tungsten surfaces were measured using UHV-technique (all-metal-valves, titanium-sublimations-pumps, and sensitive mass-spectrometers). In the low pressure range ($10^{-3} - 10^{-1}$ Pa) a relative (related to Xe/gas covered W) and the absolute hot-wire method were compared. The latter method gave only insignificantly lower values for tungsten/noble gases. In the temperature range 300 ~ 370°K, measurements were made with all noble gases on tungsten, and the results are compared with earlier measurements. A remarkable influence of the surface structure on the a.c. value (roughness, texture of the wires and foils) was found. (auth)

7090 EFFECT OF THE LIGHT ELEMENTS NITROGEN, CARBON, AND OXYGEN ON THE PHYSICAL PROPERTIES OF SPUTTERED TANTALUM FILMS. Huttemann, R. D.; Morabito, J. M.; Steidel, C. A.; Gerstenberg, D. (Bell Telephone Labs., Inc., Allentown, PA). Jap. J. Appl. Phys.; No. Suppl. 2, 513-516 (1974).

From 6th international vacuum congress; Kyoto, Japan (25 Mar 1974). See CONF-740353-.

The structural and electrical properties of reactively sputtered tantalum films are shown to be a strong function of the nitrogen, carbon, and oxygen concentration in the films and of sputtering voltage. Transitions from the tetragonal β-Ta structure to a mixture of β-Ta and bcc-Ta, and finally to a single phase bcc-Ta region, followed by nitride, carbide or oxide phases have been observed by x-ray diffraction. In addition, film structure has been correlated for two sputter conditions to Ta-film composition as determined by Auger electron spectroscopy combined with ion sputtering during analysis. It is shown that once the functional relationships between sputtering voltage, composition, and film properties have been established, the monitoring of resistivity temperature coefficient of resistance, (TCR), and spectrophotometry of 60-V anodic films can serve a diagnostic control function in the deposition of the Ta-film component materials. (auth)

7091 EQUILIBRIUM DISTRIBUTION COEFFICIENTS OF BINARY COPPER-ADMIXTURE SYSTEMS. Kuchar, L.; Le Cao Tac. Sb. Ved. Pr. Vys. Sk. Banske Ostrave, Rada Hutn.; 18: No. 3, 65-76(1973). (In Czech).

Approximate equations for the solidus and liquidus were calculated with a computer for the Cu-admixture systems on the basis of available data, these admixtures being Ag, Al, As, Au, Be, Cd, Ga, Fe, In, Li, Mg, Mn, P, Sb, Si, Sn, Tn, Zn, and Zr. Distribution coefficients were calculated for these systems in temperature intervals from 1083°C to the eutectic melting points. A table is shown for Cu–As as an example. Similar work on 15 systems of

Au + admixtures is mentioned but the results are not given. Limit values of the distribution coefficient $k_{0\,lim}$ (for very pure metals) are shown for the systems Cu + Al, Zn, Au, Si, Ga, Ag, Mn, Ti, Ge, In, Li, Be, As, Sn, Mg, Sb, Zr, Th, P, Cd, the system Ag + Pd, Au, Cd, Mg, In, Al, Li, Cu, Hg, Sn, Ga, Be, Sb, Ge, Pb, As, Bi, and the systems Au + Pd, Pt, Ag, Mn, Cu, Zn, Cd, Mg, Ga, In, Al, Sn, Ge, U, and Th. A plot and a table is given showing the periodicity of $k_{0\,lim}$ values. Thus $k_{0\,lim}$ values can be predicted for systems values of which have not yet been measured. (Metals Abstr.)

7092 MOLYBDENUM CORNER OF THE MOLYBDENUM–ZIRCONIUM–NICKEL TERNARY SYSTEM. Mal'tsev, M. V.; Zakharov, A. M.; Kurganov, G. V.; Parshikov, V. G. Nauch. Tr., Vses. Nauch.-Issled. Proekt. Inst. Tugoplavkikh Met. Tverd. Splavov; No. 14, 195-199(1973). (In Russian).

Microscopic analysis, and measurements of micro-hardness and of the temperature of onset of melting, were used in a study of the Mo corner of the phase diagram of Mo–Zr–Ni alloys quenched from 1800 and 1200°C after annealing for 25 and 150 h. Isothermal sections were obtained at these quench temperatures, and a provisional projection of the liquidus surface is given. (Metals Abstr.)

7093 EFFECT OF THE SURFACE LAYER ON TRITIUM DIFFUSION IN SINGLE-CRYSTAL MOLYBDENUM. Maksumov, T. M.; Petushkov, E. E. (Inst. of Electronics, Tashkent). Dokl. Akad. Nauk Uzb. SSR; No. 10, 24-26(1974). (In Russian).

The surface of single-crystal Mo was carefully cleaned, and subjected to reaction with air at 20, 100, and 350°C for a period of 30 min. Then the samples were placed in an evacuated vessel, and exposed to tritium at a pressure of 10^{-2} torr for a period of 30 min. The thickness of the oxide layer is variable, and the oxide film has a different structure on various facets of the oxidized, single-crystal Mo. A sharp decrease in tritium concentration was noted in the surface layer having a thickness of 7 to 10 mm, and containing a higher content of oxygen and other structural defects. The lower layers contain the higher tritium content. The volume diffusion of hydrogen in Mo does not depend on the metal structure, and the log of the diffusion coefficient is found to be a linear function of 1/T: $D = 0.001 \exp(-15400/RT)$, cm^2/sec. (SJR)

7094 INFRARED ABSORPTION OF CHROMIUM-RICH Cr–Fe, Cr–Co, AND Cr–Ni ALLOYS AT 4.2K. Lynch, D. W.; Rosei, R.; Weaver, J. H. (Ames Lab., IA). Phys. Status Solidi A.; 27: 515-522(1975).

The absorptivity of dilute Cr-based alloys with Fe, Co, Ni, and Ru has been measured at 4.2°K in the range of 0.08 to 1 eV (to 4.5 eV for some samples). Peaks indicating the occurrence of the incommensurate and commensurate antiferromagnetic phases are used to compare these alloys with those having Mn and V as solutes. Except for Cr–Ru, the peaks are much broader than when Mn is used as solute. As expected from neutron scattering and magnetic data on incommensurately ordered alloys, Fe and Co behave like Mn except that the formation of a virtual bound state makes them less effective than Mn in raising the Fermi level; Ni probably behaves like V. When 2 to 7% Fe or 4% Co is present, the order is commensurate with the lattice, but the details of the absorptivity depend on the solute and its concentration. More than 7% Fe alters the Cr band structure sufficiently that the infrared peak characteristic of antiferromagnetic ordering is not present. Such band structure changes make the interpretation of magnetic data difficult. (auth)

7095 ANISOTROPY IN THE IMPACT TOUGHNESS OF DEFORMED SHEETS OF Mo ALLOYS TsM-2A AND TsM-5. Malkhasyan, N. M.; Gulyaev, A. P.; Morgunova, N. N. Strength Mater.; 6: No. 6, 722-726(Jun 1974).

Translated from Probl. Prochnosti; 6: No. 6, 67-71(Jun 1974).

Sheets 10 mm thick of these alloys were studied. It was found that the brittleness threshold (T_x) of thick (δ = 10 mm) sheets of molybdenum alloys is higher than room temperature and is anisotropic, such that the lowest value of T_x corresponds to the longitudinal direction, and the highest value of T_x corresponds to the direction at an angle of 45° and across the direction of rolling. A notch on a sheet is most dangerous if it has a direction perpendicular to the plane of rolling, the value of the impact toughness being lowered substantially above the brittleness theshold. (auth)

7096 MECHANICAL PROPERTIES OF A Ti ALLOY FROM THE SYSTEM Ti–Al–W–Zr. Kornilov, I. I.; Pronin, A. T.; Vorob'ev, N. A.; Nartova, T. T.; Fatkullina, L. P. Strength Mater.; 6: No. 6, 753-755(Jun 1974).

Translated from Probl. Prochnosti; 6: No. 6, 96-98(Jun 1974).

The phase diagram of the system Ti–Al–W–Zr up to 40 wt.% to Al and W content was studied in an effort to find Ti alloys having good hot strength and heat resistance. It was found that the alloy based on the system Ti–Al–W–Zr has a better set of mechanical properties at 600°C than current production-line high-temperature titanium alloys. It is also noted that the alloy is heat resistant in air at temperatures up to 900°C. Its oxidation rate at 900°C is close to that of Nichrome. These results show the promise of this alloy for structures working under static or cyclic load in air at temperatures up to 700°C. (auth)

7097 MAGNETIC PROPERTIES OF SOLID SOLUTIONS OF THE SYSTEM UFe_2–UCo_2. Pletyushkin, V. A.; Chechernikov, V. I.; Muzaleva, V. V.; Semenov, V. A.; Kuz'min, R. N.; Slovyanskikh, V. K. (Moscow State Univ.). Fiz. Metal. Metalloved.; 39: No. 1, 217-220(Jan 1975). (In Russian).

In explaining magnetic properties of isomorphous compounds it is assumed that the valence electrons of the actinide fill the 3d-zone of the metal of the iron group. If these electrons suffice for filling the 3d-zone, the compound should not manifest strong magnetic properties ($ThNi_5$, UCo_2). If however the 3d-zone is not completely filled, then it is possible to expect the appearance of strong magnetic properties ($ThCo_5$, UFe_2). It was of interest to note how the magnetic properties would change with a gradual replacement of atoms of one 3d-metal by atoms of another 3d-metal. Hence various mixtures of UFe_2 and UCo_2 were melted together, and pressed into pellets. All samples showed a cubic, face-centered structure of the C15 type. It was found that the value of the ferromagnetic curie temperature decreases smoothly from 157°K for the UFe_2 compound on replacing iron atoms with cobalt atoms, and tends to zero at a concentration of 60 to 65% UFe_2. On mixtures containing 100, 97.5, 95, 90, 85, 80, 75, 70, and 60% UFe_2, Mossbauer spectra were taken at room temperature and at liquid-nitrogen temperature. The presence of ferromagnetic ordering could be detected in these mixtures at 80°K. The effective field on the nucleus decreases monotonically with decreasing concentration of UFe_2. Thus these studies show that the magnetic properties of solid solutions of the system UFe_2–UCo_2 change smoothly on going from the ferromagnetic compound UFe_2 to the paramagnetic compound UCo_2. (SJR)

7098 ANISOTROPY OF THE MICROHARDNESS OF RHENIUM, SINGLE CRYSTALS. Azhazha, V. M.; Kovtun, G. P.; Elenskii, V. A.; Beloval, V. S. (Physical-Technical Inst., Kazan). Fiz. Metal. Metalloved.; 39: No. 1, 202-205(Jan 1975). (In Russian).

Rhenium, just as other metals with a hexagonal, dense-packed structure, should have a rather pronounced anisotropy of microhardness. The microhardness anistropy in single-crystal rhenium was studied to establish the effect of single-crystal purity on the magnitude of the anisotropy. Crystal purity was estimated from the change in the ratio of electrical resistance at 300 and 4.2°K, and also from mass-spectrometric and chemical methods of analysis. The average hardness and cuts parallel to various crystallographic planes were found to be: (0001)–473 kg/mm^2; $(10\bar{1}1)$–260; $(10\bar{1}0)$–221; $(11\bar{2}2)$–252; and $(\bar{1}2\bar{1}0)$ = 210 kg/mm^2. As is evident, the microhardness varies by more than a factor of two. With increasing purity of the single crystals a decrease in microhardness values is observed with an increase in anisotrophy. It was found that impurities are distributed along the basal planes of single crystal rhenium. (SJR)

7099 INTERCRYSTALLINE DISRUPTION OF PLATINUM ALLOYS. Stepanov, V. V.; Chernyshova, T. A.; Shevelev, V. V. (Ural Polytechnic Inst., Sverdlovsk, USSR). Fiz. Metal. Metalloved.; 39: No. 1, 183-188(Jan 1975). (In Russian).

A look is taken at the metallographic details of intercrystalline disruption of platinum alloys in the thermal reaction zone of a welding arc. Quantitative data are presented of the results of a study of the effect of alloying components on the migration of grain boundaries and the development of intergranular slip in the zone near the joint. The reasons for crack formation are discussed. (SJR)

7100 STUDY OF THE PLASTIC DEFORMATION OF RHENIUM, SINGLE CRYSTALS. Kopetskii, Ch. V.; Myshlyaev, M. M.; Novokhatskaya, N. I.; Yukhanov, V. A. (Inst. of Solid State Physics, Moscow). Fiz. Metal. Metalloved.; 39: No. 1, 165-174(Jan 1975). (In Russian).

A study is made of the temperature and orientation dependence of the strength parameters of rhenium single crystals. By means of electron transmission microscopy a study was carried out on the structure of deformed single crystals. From the rate dependence of the strength parameters the packing defect energy was determined at room temperature at the basal plane. The packing defect energy is equal to 430 erg/cm^2. At high temperatures (1273°K) this value is much smaller, and a breakup of dislocations is observed. A high plasticity was found for rhenium. On separate crystals the plasticity attains a value of 300% at room temperature. Twinning in rhenium single crystals contributes substantially to plastic deformation at all test temperatures. By metallographic

analysis it was determined that deformation loss in strength takes place as a result of transverse glide from the basal plane to the prismatic. (SJR)

7101 BOUNDARY RELAXATION IN NICKEL-BASED SOLID SOLUTIONS. Gridnev, V. N.; Kushnareva, N. P. (Inst. of Metal Physics, Kiev). Fiz. Metal. Metalloved.; 39: No. 1, 154-164(Jan 1975). (In Russian).

A study is made of the effect of alloying on the change in parameters of boundary glide as evidenced by measuring the internal friction (Q^{-1}) of nickel-based, replacement alloys. On the basis of a study of the high-temperature (1000 to 1200°C) internal friction of solid solutions of binary alloys of nickel with Fe, V, Ta, Nb, W, and Re, and of the ternary alloys Ni–Cr–Mo and Ni–Fe–Mo it was established that T_{max} of the high-temperature peak increases in alloys of equal concentration on alloying with elements in the following order: Fe→ V→ Cr→ Ti→ Nb→ Mo→ Ta→ Re→ W. It is shown that the changes in boundary relaxation of the solid solutions can be used to study strengthening of grain boundaries at high temperatures with respect to shear deformation and segregation of alloying element at grain boundaries. The formation of segregations in the alloys is stimulated by elastic interaction which for Fe, Cr, V, T, Mo, W, Nb, and Ta in nickel were respectively 0.04, 0.05, 0.055, 0.16, 0.46, 0.62, 0.835 and 1.25 eV on the basis of estimates, and also depends on the electron and chemical interaction (especially for Fe, V, and Cr). An estimate of the effect of alloying on the change in rate of boundary glide showed that a sharp decrease in glide rate (a number of orders of magnitude) is observed in alloys having an impurity content of 0.5 to 1.0 at.%, and only a relatively slight change with further alloying. The data correlate with changes during macroglide. In ternary alloys the boundary resistance is determined by the alloying element. (SJR)

7102 STUDY OF THE PRECIPITATION OF VANADIUM CARBIDE IN AUSTENITIC STEEL. Farber, V. M.; Bronfin, B. M. (Ural Politechnic Inst., Sverdlovsk, USSR). Fiz. Metal. Metalloved.; 39: No. 1, 140-146(Jan 1975). (In Russian).

By the methods of electron microscopy, x ray structural analyses and hardness tests, studies were made of the precipitation of vanadium carbide VC in austenitic steel having the composition 0.41 wt.% C, 12.85% Cr, 8% Ni, 8.27% Mn, 1.53% V, 0.016% P and 0.009 wt.% S. Samples in the form of disks 2.5 mm thick were homogenized to a solid solution at 1150°C in a helium atmosphere with subsequent quenching in water. Aging was carried out in a vacuum furnace at temperatures of 700 to 800°C and holding times of 1 to 32 h. It is shown that the main mechanism of precipitation is the nucleation and growth of VC particles on non-cleaved, glide dislocations. The VC particles grow on a/2 ⟨110⟩ dislocations gliding in the {110} planes. This behavior leads to the formation of precipitation bands. The almost complete absence of VC precipitation on packing defects is associated with the slight degree of supersaturation of the solid solution in vanadium and carbon atoms at the selected quench temperature. Vanadium carbide precipitation is accompanied by a decrease in the regions of coherent scattering and by an increase in the level of microdistortions and dislocation density concentrated mainly in the precipitation bands. These characteristics of the fine structure are reflected in the hardness measurements. (SJR)

7103 RELATION OF THE ORIENTATION OF TUNGSTEN CRYSTALLITES TO PERFECTING OF THE CRYSTALLITES DURING RECRYSTALLIZATION ANNEALING. Kralina, A. A.; Puzanova, L. V.; Smirnov, L. V.; Permyakov, A. I.; Romanov, E. P. (Inst. of Metal Physics, Kiev). Fiz. Metal. Metalloved.; 39: No. 1, 131-139(Jan 1975). (In Russian).

A study was made of the perfecting and orientation of tungsten crystallites formed as a result of secondary recrystallization during gradated annealing under conditions of electron-beam heating. The investigation was carried out on samples of commercial-grade, sheet tungsten with longitudinal and transverse directions of hot rolling with respect to the direction of zone movement. The recrystallized crystallites had an orientation close to {112} ⟨110⟩ and {114} ⟨110⟩. The recrystallization growth front leads the high-temperature zone by approximately 5 mm. It is shown that the high-temperature zone has an effect on the perfecting of the crystal lattice which is formed at the growth point. The degree of crystallite perfection depends both on the crystallographic orientation of the plane of the surface crystal, and also on the direction of growth. An explanation is advanced with regard to the effect of thermomechanical stresses (caused by the sharp temperature drop in the zone of electron-beam heating) on perfecting of the crystals. A discussion is presented of the inverse dependence of the preferred orientation of the crystallites on the degree of crystal lattice dislocations of the crystallites. (SJR)

7104 TEMPERATURE DEPENDENCE OF THE HALL EFFECT AND THE MOBILITY OF THIN SPUTTERED TANTALUM FILMS. Rachmann, J.; Juergens, W. (Siemens AG, Munich). Thin Solid Films; 26: No. 2, 305-310(Apr 1975). (In German).

By varying the sputtering conditions, several modifications of thin tantalum films were obtained. For α^*-, β-, α-tantalum and Ta_2N the Hall coefficient and the mobility were measured in the range from 77 to 300 K. A model was proposed to explain the change of mobility with temperature through a combination of the scattering cross section of acoustic unipolar phonons and the potential barriers of the coherent lattice. (auth)

7105 PHYSICS OF Cd-, Se-, and CdSe-NUCLEATION. Hamersky, J. (Research Inst. for Ceramic Electr.. Field, Hradec Kralove, Czech.). Thin Solid Films; 26: No. 2, 321-328(Apr 1975). (In German).

The method described earlier in this journal by the same author for measuring the critical densities of molecules above the substrate during the critical state of nucleation of layers is applied to the Cd, Se and CdSe system. The mechanism of CdSe synthesis from the components arriving at the substrate during the sublimation of the compound is established from the results obtained. (auth)

7106 MAGNETOSTRICTION OF INTERMETALLIC COMPOUNDS OF TERBIUM CONTAINING IRON AND COBALT WITH A STRUCTURE OF A TYPE OF A LAVES PHASE. Belov, K. P.; Elyutin, O. P.; Kataev, G. I.; Kim, D.; Nikitin, S. A.; Pshechenkova, G. V.; Solntseva, L. I.; Surovaya, G. N.; Taratynov, V. P. (Moscow State Univ.). Fiz. Metal. Metalloved.; 39: No. 2, 284-288(Feb 1975). (In Russian).

Gigantic values of magnetostriction are found in compounds having a cubic lattice of the Laves phase type $TbFe_xCo_{2-x}$ and $Tb_xY_{1-x}Fe_2$. It is shown that high values of the magnetostriction are conditioned by the presence of terbium ions. Criteria are established for gigantic magnetostriction at room temperature in rare earth alloys. (SJR)

7107 STRUCTURE, PHASE CONVERSIONS, AND COERCIVE FORCE OF ALLOYS BASED ON $SmCo_5$. Magat, L. M.; Makarova, G. M.; Solina, L. V.; Ermolenko, A. S.; Shcherbakova, E. V.; Shur, Ya. S. (Inst. of Metal Physics, Kiev). Fiz. Metal. Metalloved.; 39: No. 2, 295-301(Feb 1975). (In Russian).

By an x ray study of single crystal samples it was confirmed that the compound $SmCo_5$ has a single-phase structure of the type $CaCu_5$. It is shown that in the breakdown of solid solutions based on $SmCo_5$, which are enriched in cobalt, a phase Sm_2Co_{17}, precipitates in a rhombohedral modification with the structure of Th_2Zn_{17}. After quenching the alloy $SmCo_{6.4}$ from 1270°C, regions are found in the solid solution with a structure of the type of Th_2Ni_{17}. Precipitation of a small amount of the Sm_2Co_{17} phase during annealing sharply lowers the coercive force of alloy powder containing this phase after homogenization. It is possible that this behavior is conditioned by the dispersion of the phase which precipitates and by its coherent relationship with the matrix. Diffusion diffraction effects associated with the initial stages of the precipitation of the Sm_2Co_{17} phase were found on roentgenograms of $SmCo_5$ single crystals. (SJR).

7108 FEATURES OF THE ELECTROTRANSFER OF HYDROGEN ISOTOPES IN TANTALUM. Merisov, B. A.; Khadzhai, G. Ya.; Khotkevich, V. I. Fiz. Metal. Metalloved.; 39: No. 2, 324-327(Feb 1975). (In Russian).

Measurements were made of the mobility of hydrogen and deuterium in tantalum at room temperature; the effective charge is calculated. At electric fields less than 3 mV/cm it was found that the mobility as a function of the electric field has the form of a sharp maximum, that is, the mobility of hydrogen isotopes becomes anomalously large. The anomalous maximum is attained at a field of 3 mV/cm for hydrogen and 1 mV/cm for deuterium. The magnitude of the effect is smaller for hydrogen than for deuterium. This behavior may be associated with the mass ratio of the isotopes. (SJR)

7109 KINETICS OF THE EXPANSION OF A TWINNED LAYER IN INDIUM SINGLE CRYSTALS. Lubenets, S. V.; Startsev, V. I.; Fomenko, L. S. (Physical-Technical Inst. of Low Temperatures, Kharkov). Fiz. Metal. Metalloved.; 39: No. 2, 410-417(Feb 1975). (In Russian).

A study is made of the kinetics of movement of the boundaries of plane-parallel, twinned layers over a wide region of stresses at temperatures of 2.3, 77, 185, and 300°K. A comparison is carried out of kinetic regularities in plastic deformation during twinning and glide. Strengthening of the twinned layer, which is manifested by a decrease in rate of boundary movement at constant stress, is associated with the development of glide near the boundaries. The strengthening relation obtained experimentally may be a consequence of the formation of dislocation accumulations at the boundaries, whose elastic stress fields have an effect on the generation and movement of twinning dislocations. (SJR)

7110 NATURE OF THE STRONG TEMPERATURE DEPENDENCE OF NIOBIUM YIELD STRENGTH BELOW ROOM TEMPERATURE. Blanter, M. S. (All-Union Correspondence Machine Construction Inst., Moscow). Fiz. Metal. Metalloved.; 29: No. 2, 421-423(Feb 1975). (In Russian).

A substantial increase in yield point is observed in bcc metals at a temperature below $0.2T_{melt}$. This behavior is the main reason for cold brittleness. Literature data on the flow stress of single crystal niobium containing varying amounts of oxygen were compared by computer with the experimental results of Frank. The interaction energy of an occluded atom with dislocations was calculated. At large concentrations of oxygen atoms (more than 0.1 at %) the interaction energy was calculated to be 0.4 to 0.45 eV in agreement with an observed value of 0.3 eV. This behavior indicates that the theory of Frank can be used to explain the strong temperature dependence of the flow stress at high concentrations of oxygen, which is probably determined by the slowdown of moving dislocations on impurity atoms. (SJR)

7111 ALPHA-OMEGA CONVERSION IN TITANIUM AND ZIRCONIUM DURING SHEAR DEFORMATION UNDER PRESSURE. Zil'bershtein, V. A.; Chistotina, N. P.; Zharov, A. A.; Grishina, N. S.; Estrin, E. I. (Inst. of Metal Science and Physics of Metals, Moscow). Fiz. Metal. Metalloved.; 29: No. 2, 445-447(Feb 1975). (In Russian).

Samples of iodide titanium and zirconium were placed between anvil faces, and gradually compressed. Shear deformation was exerted by cyclic rotation of one of the anvils at an angle of 15°. Inflections in the change of resistance to shear under pressure were noted at 20 ± 3 kbar for titanium and 22 ± 3 kbar for zirconium. It can be assumed that these inflections are associated with $\alpha \rightarrow \omega$ and $\omega \rightarrow \alpha$ transformations. Phase analysis of samples deformed at 25 to 30 kbar showed the presence of a significant amount of ω-phase, while samples deformed at 10 to 15 kbar showed only the lines of the α-phase. The alpha-omega transformation has a martensitic character. (SJR)

7112 FORM AND PARAMETERS OF A NUMBER OF LINES OF THE X RAY, EMISSION L-SPECTRUM OF ELEMENTS OF THE SECOND LARGE PERIOD (Y, Zr, Nb, Mo, Ru, Rh, Pd, Ag, AND Cd). Nemoshalenko, V. V.; Shpak, A. P.; Krivitskii, V. P. (Inst. of Metal Physics, Kiev). Fiz. Metal. Metalloved.; 39: No. 2, 278-283(Feb 1975). (In Russian).

On a vacuum, two-crystal spectrometer a study was made of the $L\alpha_{1,2}$-, $L\beta_1$-, $L\beta_{2,15}$- and $L\gamma_1$-emission lines of the elements from yttrium to cadmium inclusively (excluding technetium). A study was carried out of the shape and parameters of these lines. The natural widths of the $L\alpha_1$- and $L\beta_1$-lines were found. The results are compared with those of Blokhin completed on a similar spectrometer in 1973. (SJR)

7113 THERMALLY ACTIVATED DEFORMATION OF URANIUM. Voloshchuk, A. I.; Kontop, Yu. F. (Physical-Technical Inst., Kazan). Fiz. Metal. Metalloved.; 39: No. 2, 347-353(Feb 1975). (In Russian).

By analyzing the temperature rate of the dependence for the plastic flow of uranium, it was possible to determine values for the activation enthalpy H and the activation volume V. It is pointed out that there is a correspondence between these values with literature data on mechanisms for the deformation of uranium metal. An estimate is made of the sizes and distribution density of barriers controlling the rate of deformation. The main types of barriers for the movement of dislocations in uranium are tetragonal inpurity defects at temperatures 200 to 350°C, and Nabarro barriers at temperatures below 100°C. At temperatures above 450°C the deformation is controlled by diffusion processes. (SJR)

7114 MECHANISM OF THE EFFECT OF RARE EARTH METALS ON THE HEAT RESISTANCE OF CHROMIUM. Mikadze, O. I.; Rakitskii, A. N.; Tavadze, F. N.; Trefilov, V. I. (Inst. of Metallurgy, Tbilisi, USSR). Fiz. Metal. Metalloved.; 29: No. 2, 430-433(Feb 1975). (In Russian).

In order to explain the possible mechanism of the effect of a rare earth addition on the heat resistance of chromium, a study was made of the structure, composition and evaporation of the oxide film, the suboxide layer, and the metal. The maximum heat resistance of chromium is observed on introducing 0.2 to 0.7 wt % La. A chromium alloy containing 1.0 wt % La, oxidized in air at 1330°C, was subjected to micro, x ray analysis, and it was found that the La content in the oxide film was 0.3 wt %. Calculation showed that the solubility of La in Cr did not exceed 0.10 wt %. No suboxide layer could be detected. It was found that the dissolution of rare earth metal (0.5 wt % La) in chromium leads to the formation of a tight, adherent oxide film with an evaporation rate of 0.01 to 0.02 mg/cm^2-h compared with an evaporation rate of 0.24 to 2.23 mg/cm^2-h for unalloyed chromium having an oxide film formed at 1150°C. (SJR)

7115 TEMPERATURE DEPENDENCE OF THE ELECTRICAL RESISTIVITY OF AMORPHOUS Ge, Sn, AND Bi ALLOYS AND ITS RELATION TO SUPERCONDUCTIVITY. Korn, D.; Muerer, W.; Zibold, G. (Konstanz Univ. (F. R. Germany). Fachbereich Physik). J. Phys. (Paris), Colloq.; No. 4, 257-260(May 1974).

From colloquium on disordered metallic systems; Strasbourg, France (10 Sep 1973).

The amorphous alloys are quench-condensed from the vapour phase on a substrate at 4K. The electrical resistivity of amorphous Ge-41 at. % Au, Bi-15 at. % Ag and Sn-x at. % Cu(x = 10 to 80) was measured. An unusual linear temperature dependence is found with negative slope for Ge, Bi, and Sn alloys and with a positive slope for Sn alloys with Cu concentration less than 60 at. %. The temperature dependent part of the electrical resistivity is explained with conduction electrons being scattered by p-electrons. The superconducting transition temperature of amorphous Sn alloys is found to be proportional to the positive slope of the normal state resistivity. (FR)

7116 ELECTRIC RESISTIVITY OF NIOBIUM AND bcc NIOBIUM-HAFNIUM ALLOYS AT LOW TEMPERATURES. Haen, P.; Teixeira, J. (Centre National de la Recherche Scientifique, 38 - Grenoble (France). Centre de Recherches sur les Tres Basses Temperatures). Rev. Phys. Appl.; 9: No. 5, 879-893(Sep 1974). (In French).

The electric resistivity of two samples of niobium and of bcc Nb-Hf alloys with various hafnium concentrations (6 to 56 at. %) was measured between their superconducting transition temperatures and room temperature. The apparatus used is also able to measure the width of superconducting transitions. By numerical analysis of the results, a mathematical expression for the resistivity of the specimens has been determined. (FR)

7117 PROPERTIES OF DUCTILE FERRITIC STAINLESS STEELS WITH HIGH CHROMIUM CONTENT AND DUPLEX STAINLESS STEELS. Hochmann, J.; Desestret, A.; Jolly, P.; Mayoud, R. (Societe Creusot-Loire, 42 - Unieux (France)). Metaux (Corros.-Ind.); 49: No. 591, 390-414(Nov 1974). (In French).

From international colloquium on stress corrosion and hydrogen embrittlement of iron base alloys; Unieux-Firminy, France (12 Jun 1973).

The main results obtained on the high chromium ferritic steels and the duplex steels are summed up and discussed. The metallurgical problems involved in the production and the fabrication of these alloys are described, together with their properties, particularly their corrosion resistance. Resistance to stress corrosion cracking is excellent for the ferritic steels in a great variety of environments, when kept sufficiently low in the residual amounts of nickel, copper, or cobalt. Resistance to intergranular corrosion is also very good due to the extremely low levels of carbon and nitrogen; this resistance can still be improved by aluminium additions. The resistance to stress corrosion cracking of the duplex steels is probably related to complex phenomena of galvanic coupling between both phases. Consequently, their relative proportions, their respective distribution, morphology, and composition may sometimes exert a great influence. In some cases, it seems there exists a threshold stress below which cracking is much slowed down, if not stopped; this phenomenon is very probably under the dependence of the factors listed above. The exact knowledge of the domain for safe utilization of the duplex steels makes possible the solution of numerous industrial problems. (FR)

7118 SUPERCONDUCTING TRANSITION TEMPERATURES OF ULTRATHIN AMORPHOUS FILMS. Granqvist, C. G.; Claeson, T. (Chalmers Tekniska Hoegskola, Goetborg (Sweden). Institutionen foer Fysik). J. Phys. (Paris), Colloq.; No. 4, 301-303 (May 1974).

From colloquium on disordered metallic systems; Strasbourg, France (10 Sep 1973).

The superconducting transition temperature of vapour-quenched, amorphous films of Bi and Ga is suppressed by a factor of two as the thickness is decreased from 50 to 3nm. The thickness dependence agrees with a proximity type model in which the film consists of a thin, nonsuperconducting, surface layer in contact with a remaining, bulk superconducting part. (FR)

7119 INTERPRETATION OF ANISOTHERMAL RELAXATION TESTS. Application to Expansion Heat Treatments of Slightly Alloyed Steel Pressure Vessels. Leymonie, C. (Societe Babcock-Atlantique, 44 - Saint-Nazaire (France)). Mem. Sci. Rev. Metall.; 71: No. 10, 609-620(Oct 1974). (In French).

From autumn meeting on metallurgy; Paris, France (1 Oct 1973).

Anisothermal relaxation tests by traction carried out since 1966 have been interpreted by the detailed study of form steels: 18MNV6, 20M5, 20N14 and 15CD9.10. During heating sigma

varies as R_e until generalized creep occurs in the specimen, accelerating relaxation. During temperature maintenance sigma varies linearly with the parameter P = T(20 + log t) which expresses the preponderant influence of temperature. During cooling sigma increases: in the absence of creep the sigma increase can be calculated from the Youg's modulus variation; in the presence of generalized creep the sigma increase is larger than that calculated and all the more so as the maximum temperature of the cycle is higher. For practical purposes the tests carried out show that the temperature-time equivalence rules and the maintenance rules fixing a value per unit thickness are not justified. A 2-hour maintenance at the maximum temperature should be enough to provide a strong relaxation of stresses. The treatment conditions should be so chosen as to guarantee given mechanical properties in the object concerned. (FR)

7120 EFFECT OF STRONG LATTICE-DISORDER ON THE SUPERCONDUCTING TRANSITION TEMPERATURE AND ON FERROMAGNETISM. Bennemann, K. H. (Freie Univ. Berlin (F. R. Germany). Inst. fuer Theoretische Physik). J. Phys. (Paris), Colloq.; No. 4, 305-307(May 1974).

From colloquium on disordered metallic systems; Strasbourg, France (10 Sep 1973).

A theory is presented to explain for simple metals and transition metals the dependence of the superconducting transition temperature on the changes in the phonon frequency spectrum, electronic density of states and in the electronic matrix elements which result from strong lattice-disorder. Also, we show for Ni, that strong lattice-disorder reduces the d-electron spin polarization. (FR)

7121 OPTICAL PROPERTIES OF SMALL IN PARTICLES IN THIN-FILM FORM. Hetrick, R. E.; Lambe, J. (Ford Motor Co., Dearborn, MI). Phys. Rev., B.; 11: No. 4, 1273-1278(15 Feb 1975).

Reflectance studied in the 1.0- to 0.2-mu m region were made on thin In films which exhibit a discontinuous islandlike structure. Results of phase-shift measurements demonstrate that the optical properties of these films are dominated by interference effects. Two features are of particular interest. First, when the films are placed above a highly reflecting substrate, strong coloration indicative of a reflective interference filter is observed. Secondly, it is found that In films are very sensitive indicators of thin transparent layers. Layers as thin as 50 A are easily observed when applied as overcoats on In films. Both of these aspects are discussed in terms of the optical response of the small particles composing the film. (auth)

7122 LASER-INDUCED ELECTRON EMISSION. Bechtel, J. H.; Franken, P. A. (Univ. of Michigan, Ann Arbor). Phys. Rev., B.; 11: No. 4, 1359-1364(15 Feb 1975).

Laser-induced electron emission from tungsten was observed using Q-switched ruby lasers. Experimental results from tungsten indicate that processes other than thermionic emission can occur at irradiances of tens of megawatts per square centimeter and pulse durations of tens of nanoseconds. For these irradiances and pulse durations the emitted electron pulses have maximum currents in the range of 0.1 to 100 mA, and this maximum current is delayed approximately 5 nsec with respect to the maximum incident irradiance. The measured time delay is consistent with a thermal origin for the electron emission process. However, the relation between the emitted current and the incident laser irradiance is substantially less nonlinear than that predicted by the Richardson-Dushman equation. An effect that we call two-photon-assisted thermionic emission is proposed to explain the observed data, and the experimental results are compared to a model for this effect. In addition, results are obtained from tungsten ribbon cathodes, the initial temperature of which could be varied by changing the current in the ribbon. In this case, however, when the maximum emitted current is compared to the intial cathode temperature for a constant maximum irradiance, the results are more consistent with thermionic emission than with the two-photon-assisted thermionic emission process. This difference is as yet unexplained. (auth)

7123 OBSERVATION OF THE STRUCTURE OF THE INTERMEDIATE STATE PRODUCED IN TIN CYLINDERS BY A CURRENT. Kan, Ya. S.; Frolov, V. A. (Inst. of Physics and Tech., Kharkov). JETP Lett. (USSR) (Engl. Transl.); 20: No. 7, 210-211(5 Oct 1974).

Translated from Zh. Eksp. Teor. Fiz., Pis'ma Red; 20: No. 7, 461-464(5 Oct 1974).

By measuring the distribution of the magnetic permeability along a current-carrying cylindrical superconductor in the intermediate state details of the intermediate-state structure were observed. (auth)

7124 THERMAL EXPANSION OF ERBIUM AT LOW TEMPERATURES. Petrenko, N. S.; Popov, V. P.; Pushkarev, E. A.; Finkel, V. A. (Kharkov State Univ.). Phys. Status Solidi B.; 68: No. 2, K145-K148(1 Apr 1975).

The thermal expansion of 99.9% polycrystalline Er was measured at 2 to 300°K. The thermal expansion of erbium reveals fair correlation with changes in its magnetic structure: the growth of magnetic structure period at a reduced temperature (longitudinal static-spin-wave type) is in agreement with the low thermal expansion coefficients, the period drop at a reduced temperature (complex spiral type) is in agreement with high α-values. The absence of the dependence of the magnetic structure period on temperature (22 to 30°K) results in a thermal expansion coefficient reversal to zero and finally the jump of the magnetic structure period complies with the elongation jump. (auth)

7125 THERMOCHEMISTRY OF LUTETIUM–TIN ALLOYS. Bayanov, A. P.; Ganchenko, E. N.; Kulagina, N. G. (Kuban State Univ., Krasnodar, USSR). Russ. J. Phys. Chem.; 48: No. 8, 1258-1259(Aug 1974).

Translated from Zh. Fiz. Khim.; 48: No. 8, 2120-2122(Aug 1974).

Data on the enthalpies of formation of the compounds $LnSn_3$ of various lanthanides and for their heats of solution in liquid tin have been compiled. It is suggested that the atomic 5d electron is not involved in bonding. The thermodynamic characteristics of the transfer of lutetium from the pure metal to the alloy with tin containing 12.6% of lutetium have been determined by an emf method in the range 733 to 873°K. (auth)

7126 ESTIMATION OF THE COMPOSITION OF MICROGROUPS IN METALLIC MELTS FROM THE HEATS OF SOLUTION. Lebedev, V. A.; Nichkov, I. F.; Raspopin, S. P. Russ. J. Phys. Chem.; 48: No. 8, 1251-1253(Aug 1974).

Translated from Zh. Fiz. Khim.; 48: No. 8, 2112-2114(Aug 1974).

On the basis of the similarity of the heats of solution and heats of formation of certain compounds, it is suggested that groups close in composition to the following compounds exist in binary metallic melts: Sm_2Sn_3; $LaZn_4$; La_3Sb_2; U_3Bi_4; UAl_3. (auth)

7127 ELECTRONIC STRUCTURE AND PHASE DIAGRAMS OF BINARY ALLOYS WITH COMPLEX LATTICES. II. Mg–Cd System. Zhorovkov, M. F.; Fuks, D. L.; Panin, V. E. (Tomsk State Univ., USSR). Phys. Status Solidi B.; 68: No. 2, 767-773 (1 Apr 1975).

A general theory given in a previous paper is the basis for theoretical determination of the structures of ordered phases in binary alloys with complex lattice and is used for an investigation of the system Mg–Cd. The equilibrium value of the lattice parameter a in the disordered solution is calculated as a function of concentration. For a definite model potential the energetically favored superstructures are obtained and compared with those observed experimentally. (auth)

7128 CRYSTAL EQUILIBRIUM AND PHONON DISPERSION IN RARE-EARTH H. C. P. METALS. Sinha, H. P.; Upadhyaya, J. C. (Agra Coll. India). Phys. Status Solidi B.; 68: No. 2, 719-726(1 Apr 1975).

The phonon dispersion in hcp Tb and Ho is investigated on the basis of a model which uses a 5-neighbor–central pair potential for close-range forces and a screened Coulomb interaction for long-range forces. The model considers completely the equilibrium of the ionic lattice in a medium of an uniform electron gas. Consequently two equilibrium conditions, necessary for the hcp structure, are deduced and used in the study. (auth)

7129 INFLUENCE OF MECHANICAL STRESS ON THE STRUCTURAL PHASE TRANSITIONS IN V_3Si AND Nb_3Sn. Pietrass, B. (Academie der Wissenschaften, Dresden). Phys. Status Solidi B.; 68: No. 2, 553-560(1 Apr 1975).

The influence of external mechanical stress on the lattice transformations in V_3Si and Nb_3Sn is investigated on the basis of Landau's theory of phase transitions. The calculated phase diagrams for uniaxial [001] and [110] stress are found to have a critical and a tricritical point. Discrepancies are indicated between theoretical results and experimental observations of the effect of an uniaxial [001] pressure in V_3Si. (auth)

7130 THICKNESS AND TEMPERATURE DEPENDENCE OF THE CRITICAL MAGNETIC FIELD OF THIN SUPERCONDUCTING FILMS OF THE ALUMINUM GROUP METALS. Reale, C. (Thin Film Research Inst., Milan). Acta Phys. Acad. Sci. Hung.; 37: No. 1-2, 53-60(1974).

Measurements were carried out of the critical magnetic field required to destroy superconductivity in vacuum-deposited polycrystalline aluminium, gallium, indium, and thallium films with

thicknesses ranging from 500 to 10,000 Å. The results are found to be in reasonable agreement with the predictions of the Ginzburg–Landau theory for films of type I superconducting materials, if one assumes that the penetration depth of the field varies with film thickness according to a low-temperature form of the Fuchs–Sondheimer–Mayer charge-transport equation modified to include the contribution of the normal-state resistivity component arising from small-angle electron-phonon collisions. (auth)

7131 NASCENT VORTICES IN TYPE-II SUPERCONDUCTORS. Walton, B. L. Santa Cruz, CA; Univ. of California (1974). 268p. University Microfilms Order No. 75-6985.

Thesis (Ph. D.).

The microwave surface impedance of the Type-II superconductor $Pb_{.83}$-$In_{.17}$ at 1.5°K has been measured at 35 GHz for the principle orientations of the applied magnetic field and the microwave currents in the sample. In addition, some measurements of the surface impedance of the superconducting alloys $Pb_{.93}$-$Tl_{.93}$ and $Pb_{.83}$-$In_{.17}$ at 1.5°K and at 1 GHz were made for peak microwave fields of up to and exceeding the lower critical field H/sub c1/ in the respective alloy. All of our experiments provide evidence for the existence of vortex nucleation sites or nascent vortices on sample surfaces parallel to the applied magnetic field. (MHR)

7132 SPONTANEOUS MAGNETOSTRICTION IN $ThCo_5$. Buschow, K. H. J.; Brouha, M.; Langereis, C. (Philips Gloeilampenfabrieken NV, Eindhoven, Netherlands). Solid State Commun.; 16: No. 6, 789–790(15 Mar 1975).

The spontaneous magnetostriction of the hexagonal compound $ThCo_5$ was studied by X-ray diffraction. Below the Curie-temperature a large positive spontaneous magnetostriction occurs, primarily along the c-axis. (auth)

7133 NMR IN HEAVY RARE EARTH METALS AND ALLOYS. Itoh, J.; Sano, N.; Shimizu, K. (Osaka Univ.). Pure Appl. Chem.; 40: No. 1–2, 73–81(1974).

From 5th international symposium on magnetic resonance; Bombay, India (14 Jan 1974).

Nuclear magnetic resonance responses of ^{159}Tb, ^{163}Dy, and ^{167}Er in Tb, Dy and Er metals, and of Gd–Tb, Gd–Dy, Gd–Er, Tb–Dy, Tb–Er, and Dy–Er alloys have been measured at the liquid helium temperature by the spin echo method. At this temperature all these metals and alloys are in magnetically ordered states, being either ferromagnetic, spiral or conical. Over the entire concentration range the NMR responses were measured systematically, and the changes of magnetic dipole and electric quadrupole hyperfine energies were investigated. These hyperfine interactions arise mainly from the unfilled 4f shell, but there exist some contributions originating from the lattice and conduction electrons. From the results of the measurements an attempt was made to separate the contributions arising from different origins. (auth)

7134 MAGNETIC RESONANCE AND RELATED STUDIES IN SOME CERIUM AND SAMARIUM COMPOUNDS. Malik, S. K.; Vijayaraghavan, R.; Garg, S. K.; Ripmeester, R. J. (Teta Inst. of Fundamental Research, Bombay). Pure Appl. Chem.; 40: No. 1–2, 223–258(1974).

From 5th international symposium on magnetic resonance; Bombay, India (14 Jan 1974).

The results of nuclear magnetic resonance (NMR) and susceptibility measurements in $CePt_2$, $CePt_5$, and $CeSn_3$ are presented together with other available results on these compounds. The magnetic susceptibility of both $CePt_2$ and $CePt_5$ can be understood on the basis of the crystal field splitting of the ground level of Ce^{3+} ion. There are two non-equivalent Pt sites in $CePt_5$ and, consequently, two ^{195}Pt NMR lines with different Knight shifts have been observed. The ^{195}Pt Knight shifts in $CePt_2$ and $CePt_5$ are proportional to the corresponding bulk susceptibilities in the temperature region 100 to 300°K. The magnetic susceptibility of $CeSn_3$ shows a broad maximum around 135°K and a rapid rise below 30°K. The ^{119}Sn Knight shift in $CeSn_3$ in the temperature region 1.2 to 300°K is not proportional to the bulk susceptibility. In samarium compounds, the 4f contribution to the Knight shift of the nonmagnetic constituent is expected to cross over (or pass through zero) at a temperature of about 300°K, called the crossover temperature (T_{co}). Though this has been observed in many samarium compounds, the crossover in the Knight shifts is absent from $SmSn_3$, $SmAl_2$ and SmF_3, while T_{co} = 230°K in $SmPt_2$. It is shown that because of the mixing of the excited J levels of Sm^{3+} ion into its ground level by crystal fields, the crossover temperature may be considerably reduced from the value of 300°K in free Sm^{3+} ion or crossover completely suppressed. The crystal field effects on other magnetic properties of Sm^{3+} ion are also discussed. The crystal fields may introduce one or more crossover(s) in the 4f-induced hyperfine field (H_{4f}/H) at a samarium nuclear site in the paramagnetic state while H_{4f}/H is positive throughout for free Sm^{3+} ion. In ferromagnetic compounds the crystal fields may reduce or enhance the magnetic moment of Sm^{3+} ion (compared to free ion value) and in some cases Sm^{3+} ion behaves effectively like an (L + S) ion rather than an (L – S) ion. Moreover, the Sm^{3+} magnetization also shows a crossover, the temperature of which depends on the crystal fields. (auth)

Radiation Effects

Refer also to abstracts 6230, 8019, 8027, and 8076.

7135 (AD/A-002343) MONTE CARLO ANALYSIS OF X-RAY AND GAMMA-RAY TRANSITION ZONE DOSE AND PHOTO-COMPTON CURRENT. Interim Report, May–September 1973. Chadsey, W. L. (Science Applications, Inc., McLean, Va. (USA)). 16 Nov 1973. Contract F19628-71-C-0198. 49p. (SAI-73-578-AR). NTIS $3.75.

The POEM Monte Carlo electron transport code has been used to calculate dose and photo-compton current distributions near interfaces between dissimilar materials irradiated by x rays and gamma rays. The calculations were performed for a planar gold–aluminum interface irradiated by 300 kVp and 1000 kVp x-ray bremmsstrahlung spectra, a ^{60}Co gamma ray spectrum, and 30, 100, and 200 keV monochromatic x-ray spectra. For the monochromatic x-ray spectra several angles of x-ray incidence between 0 and 85 degrees with respect to the interface normal were used. The results of the dose distribution calculations for the x-ray bremstrahlung spectra are compared with the unpublished data of Wall. The results for the ^{60}Co gamma ray spectrum are compared with the published data of Wall and Burke. (GRA)

7136 (AED-CONF–74-516-007) CRITICAL CURRENT CHANGES IN LOW TEMPERATURE FAST NEUTRON IRRADIATED NIOBIUM. Brown, B. S. (Argonne National Lab., Ill. (USA). Materials Science Div.). 1974. 6p. INIS.

From international discussion meeting on flux pinning in superconductors; St. Andreasberg, F. R. Germany (23 Sep 1974).

5 figs.; 8 refs. Published in the proceedings.

Flux line pinning in irradiated niobium was chosen as a system to be studied both to investigate the technologically interesting problem of radiation damage in superconductors as well as to serve as a system characterized by a single type of defect for the investigation of flux line-defect interaction. The damage introduced into the crystals at liquid helium temperature by the fast neutrons is in the form of defect cascades. The magnetization curves for single-crystal niobium, the change in magnetic remanence as a function of change in H_{c2} and annealing temperature, the bulk pinning force depending upon the reduced field, and the maximum defect pinning interaction force calculated using the Labusch theory are discussed. (GE)

7137 (AED-CONF–74-587-048) TEMPERATURE AND DOSE DEPENDENCE OF SWELLING OF AUSTENITIC STEELS IRRADIATED IN THE BR-5 REACTOR. Shcherbak, V. I.; Bykov, V. N.; Dmitriev, V. D.; Kostromin, L. G.; Ladygin, A. Ya.; Porollo, S. I. (Institute of Physics and Power Engineering, Obninsk (USSR)).

From European conference on irradiation behaviour of fuel cladding and core component materials; Karlsruhe, F. R. Germany (3 Dec 1974).

8 figs.; 3 tabs.; 7 refs.

The results on radiation-induced swelling of austenitic chromium–nickel steels used as structural materials of the BR-5 reactor carbide core are discussed. Hexagonal tubes and fuel pin claddings in pin assemblies of the BR-5 carbide core made of the austenitic steels KH18N9T, 1KH18N10T, and KH16N15M3B were irradiated in the temperature range of 430–590°C up to the doses of 4.3×10^{22} n/cm^2. (GE)

7138 (CEA-CONF-2717) CALCULATIONS CONCERNING DECHANNELING BY DEFECTS. Mory, J. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. d'Etudes des Combustibles a Base de Plutonium). 1974. 11p. (In French). INIS.

From meeting on particle channeling; Saclay, France (27 May 1974).

The dechanneling coefficient (or the dechanneling cross section) of a particle by a crystalline defect depends on the particle-defect distance and the transverse energy (therefore the propagation angle) of the particle at the time of interaction. Therefore it depends on the space and angular distribution of the canalons. Knowing the mathematical form of these two distributions it is then possible to calculate the dechanneling coefficient (or the dechanneling cross section) of a canalon beam by a given defect. This calculation, applied to the case of dechanneling by a stacking defect and to that of a small interstitial atom, gives results which agree well with the experiment. (FR)

7139 (CEA-CONF-2882) THEORY OF COLLISION BETWEEN AN ATOM AND A SIMPLE CUBIC HARMONIC LATTICE. Comparison with Some Recent Experimental Results. Armand, G.; Lapujoulade, J. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Services de Physique Generale). 6 Jun 1974. 11p. INIS.

From 9th international symposium on rarefied gas dynamics; Gottingen, F. R. Germany (15 Jul 1974).

A theoretical calculation of neutral atom collision on a simple cubic lattice has been recently achieved, taking into account the lattice temperature. All the interaction between atoms are of harmonic type. The lobe of reflection is computed assuming conservation of incident tangential momentum. The purpose is to compare calculated and experimental results. In the case of helium and neon beams colliding on silver with different lattice temperature, incident angle and incident particle energy, one obtains a good agreement as far as the inelastic part of the lobe is concerned. The elastic part of the lobe is not theoretically obtained with an helium beam of very low incident kinetic energy. So the theory suggests the existence of a localized surface mode due to the helium or neon-lattice interaction, the frequency of which is respectively of the order of 3 and 1.6 times the maximum frequency of the bulk. (FR)

7140 (CEA-CONF-2923) INFLUENCE OF DISLOCATIONS ON VOID FORMATION IN Mg AND Al IRRADIATED BY FAST NEUTRONS. Risbet, A.; Brebec, G.; Levy, V.; Lanore, J. M. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physique des Reacteurs et de Mathematiques Appliquees). 1974. 4p. (In French). INIS.

From European conference on irradiation behaviour of fuel cladding and core component materials; Karlsruhe, F. R. Germany (3 Dec 1974).

Irradiation damage produced by fast neutrons in Al and Mg was analyzed in order to study the void nucleation and growth mechanisms. The measurements were made by electron microscopy. The influence of radiation doses (from 7×10^{17} to 3.1×10^{21} n cm^2, e > 0.1 MeV) and neutron flux (from 9×10^{12} to 3.5×10^{14} n cm^2 s^{-1}) was studied. (FR)

7141 (CEA-CONF-2925) SIMULATION OF IN-PILE RADIATION EFFECTS IN AUSTENITIC STAINLESS STEEL 316 USING HEAVY ION BOMBARDMENT. Delaplace, J.; Azam, N.; Le Naour, L. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Technologie). 1974. 4p. (In French). INIS.

From European conference on irradiation behaviour of fuel cladding and core component materials; Karlsruhe, F. R. Germany (3 Dec 1974).

Radiation-induced swelling and dislocations in austenitic stainless steels 316 were studied using Ni^+ ion beams. It was observed that swelling is the lower as the C content of austenitic is high and the dislocation density increases from the beginning of the irradiation up to a constant value. (FR)

7142 (CONF-741232-, pp 1-6) INFLUENCE OF VACANCY LOOPS ON THE SWELLING OF IRRADIATED MATERIALS. Bullough, R.; Eyre, B. L.; Krishan, K. (AERE, Harwell, Eng.). 1974.

From European conference on irradiation behaviour of fuel cladding and core component materials; Karlsruhe, F. R. Germany (3 Dec 1974).

In European conference on irradiation behaviour of fuel cladding and core component materials.

Rate theory was used to calculate swellings for M316 steel. Results are consistent with nucleation of interstitial loops. Effects of vacancy loops on the swelling are considered for heavy-ion, reactor, and electron irradiations. (DLC)

7143 (CONF-741232-, pp 9-12) SIMPLE THEORY OF SUBASSEMBLY BOWING AND SOME IMPLICATIONS FOR THE INTERPRETATION OF VOIDAGE SWELLING DATA. Anderson, R. G. (UKAEA, Springfields, Eng.). 1974.

From European conference on irradiation behaviour of fuel cladding and core component materials; Karlsruhe, F. R. Germany (3 Dec 1974).

In European conference on irradiation behaviour of fuel cladding and core component materials.

A model requiring minimum swelling information (4 values) to give subassembly bow was developed. Attention is focused on the response of fuel wrappers (ducts) in the so-called Free-Standing Core. The method can be used for structural problems in which material properties have a substantial random component. (DLC)

7144 (CONF-741232-, pp 13-16) EFFECT OF DISLOCATIONS ON THE FORMATION OF CAVITIES IN MAGNESIUM AND ALUMINUM IRRADIATED WITH FAST NEUTRONS. Risbet, A.; Brebec, G.; Lanore, J. M.; Levy, V. (CEN, Saclay, France). 1974. (In French).

From European conference on irradiation behaviour of fuel cladding and core component materials; Karlsruhe, F. R. Germany (3 Dec 1974).

In European conference on irradiation behaviour of fuel cladding and core component materials.

The evolution of irradiation damage induced by fast neutrons was studied in Al and Mg at neutron doses from 7×10^{17} to 3.1×10^{21} n/cm^2 with E > 0.1 MeV and instantaneous fluxes of 9×10^{12} to 3.5×10^{14} n/cm^2. Electron microscopic studies showed that the number of cavities varies linearly with the dose and that the rate of initial germination is proportional to the instantaneous flux. Preinjected gas increases the number of cavities and the first cavities germinate in the vicinity of dislocations. The swelling of Al and Mg follows a linear law as a function of the dose. Comparison of the experimental results with the Brebec theoretical model shows that this model does not explain the phenomenon occurring at the beginning of the irradiation where the growth kinetics of the cavities is different and there is a much more rapid growth of cavities. In order to define the role of dislocations on the growth of cavities the phenomenon was simulated by the Monte Carlo method which resulted in kinetics in good agreement with experimental results. (JSR)

7145 (CONF-741232-, pp 17-19) IRRADIATION/ANNEALING MODE OF VOID FORMATION IN MOLYBDENUM. Evans, J. H. (AERE, Harwell, Eng.). 1974.

From European conference on irradiation behaviour of fuel cladding and core component materials; Karlsruhe, F. R. Germany (3 Dec 1974).

In European conference on irradiation behaviour of fuel cladding and core component materials.

A model has been previously proposed in which the vacancies surviving the recombination process cluster and collapse to either vacancy loops or voids. To test whether the model could give vacancy retention efficiencies sufficient to explain the measured void swelling, a computer program was developed. Main results show the importance of interstitial loop content which controls the retention, the small dependence of swelling on void nucleation, and that the measured swelling of 0.36% is well within the range of the model. (DLC)

7146 (CONF-741232-, pp 21-24) USE OF HEAVY ION BOMBARDMENT FOR THE SIMULATION OF THE EFFECTS OF IN-PILE IRRADIATION IN TYPE 316 AUSTENITIC STEELS. Delaplace, J.; Azam, N.; LeNaour, L. (CEN, Saclay, France). 1974. (In French).

From European conference on irradiation behaviour of fuel cladding and core component materials; Karlsruhe, F. R. Germany (3 Dec 1974).

In European conference on irradiation behaviour of fuel cladding and core component materials.

Advantages and disadvantages of the use of heavy ion bombardment are briefly summarized. Experimental results on the swelling and evolution of dislocations under the effects of irradiation by Ni^+ ions at 500 keV are summarized. Effects of temperature, dose, and flux on the swelling and dislocation density are shown graphically. (6 figures) (JSR)

7147 (CONF-741232, pp 25-28) SWELLING OF COLD WORKED STAINLESS STEEL: SOME EFFECTS OF PROCESSING. Appleby, W. K.; Challenger, K. D. (General Electric Co., Sunnyvale, CA). 1974.

From European conference on irradiation behaviour of fuel cladding and core component materials; Karlsruhe, F. R. Germany (3 Dec 1974).

In European conference on irradiation behaviour of fuel cladding and core component materials.

He implantation and bombardment by 5-MeV Ni ions were used to simulate neutron-induced swelling in cold-worked Type 316 stainless steel. A final aging of 200 h at 593°C was used to simulate in-reactor thermal exposure. Effects of cold work, annealing temperature, and swaging were studied. (DLC)

7148 (CONF-741232-, pp 29-32) INFLUENCE OF INCREMENTAL HELIUM IMPLANTATION AND TEMPERATURE CHANGES DURING IRRADIATION WITH 46.5 MeV Ni^{6+} IONS ON VOID SWELLING IN 321 STAINLESS STEEL. Mazey, D. J.; Nelson, R. S. (Atomic Energy Research Establishment, Harwell, Eng.). 1974.

From European conference on irradiation behaviour of fuel cladding and core component materials; Karlsruhe, F. R. Germany (3 Dec 1974).

In European conference on irradiation behaviour of fuel cladding and core component materials.

Void swelling in 20% CW 321 stainless steel was studied using 46.5 MeV Ni^{6+} ions as a function of dose at 500°C and at 625°C with 1.6 ppM helium being implanted incrementally every 10 dpa. The most striking features of the curves obtained are the rather

high incubation doses which must be attained before appreciable swelling is observed. Previous work had indicated that in the case where 10^{-5} atom/atom helium had been implanted prior to irradiation the swelling of 20% CW 321 at 500°C was ~0.1% at 10 dpa. This difference is readily understood as it had already been shown that the swelling in 321 steel was rather sensitive to helium. In the present experiments, therefore, one essentially has to wait until sufficient helium has been implanted before the transition from gas bubble to void growth can occur. Once this has taken place, however, the swelling rises extremely rapidly. (auth)

7149 (CONF-741232-, pp 33-36) EFFECT OF THERMO-MECHANICAL TREATMENT ON VOID SWELLING OF A STAINLESS STEEL DURING PROTON IRRADIATION. Westin, R.; Bergenlid, U.; Engman, U.; Holmqvist, B. (AB Atomenergi, Studsvik, Sweden). 1974.

From European conference on irradiation behaviour of fuel cladding and core component materials; Karlsruhe, F. R. Germany (3 Dec 1974).

In European conference on irradiation behaviour of fuel cladding and core component materials.

The study was carried out on the 12R72HV steel (15% Co, 15% Ni, Mo, Ti, B) after different thermal treatments and cold working. High neutron doses were simulated by helium implantations and proton irradiations. Results are in reasonable agreement with neutron and carbon ion irradiations. (DLC)

7150 (CONF-741232-, pp 37-39) VOID FORMATION IN NICKEL-ION IRRADIATED NICKEL. Sprague, J. A.; Westmoreland, J. E.; Smidt, F. A. Jr.; Malmberg, P. R. (Naval Research Lab., Washington, DC). 1974.

From European conference on irradiation behaviour of fuel cladding and core component materials; Karlsruhe, F. R. Germany (3 Dec 1974).

In European conference on irradiation behaviour of fuel cladding and core component materials.

>99.995% pure Ni foils were bombarded with 2.8-MeV Ni^+ ions at 575, 625, and 675°C at a damage rate of 7×10^{-2} dpa/s. Analysis of results indicate that: below the temperature of maximum swelling, void formation is limited by void growth, while above it, it is limited by void nucleation; the swelling rate decreased between 4 and 13 dpa, suggesting a change in the dislocation structure. (DLC)

7151 (CONF-741232-, pp 41-44) EFFECT OF VOID DENSITY AND CARBON CONCENTRATION ON THE SWELLING OF TYPE 316 STEEL IRRADIATED IN AN HVM. Makin, M. J.; Walters, G. P. (AERE, Harwell, Eng.). 1974.

From European conference on irradiation behaviour of fuel cladding and core component materials; Karlsruhe, F. R. Germany (3 Dec 1974).

In European conference on irradiation behaviour of fuel cladding and core component materials.

Effects of C, Sr, and gas (N) content was investigated in 316 stainless steel using electron irradiation to produce the void swelling. Void density, mean void diameter, and swelling were determined as a function of dose at 500, 600, and 650°C for each C content. (DLC)

7152 (CONF-741232-, pp 45-49) EFFECT OF VACANCY SUPERSATURATION, GAS CONCENTRATION AND IRRADIATION TEMPERATURE ON VOID FORMATION IN DISPERSION HARDENED AUSTENITIC STAINLESS STEEL. Singh, B. N. (Danish Atomic Energy Commission Research Establishment Risoe, Roskilde, Denmark). 1974.

From European conference on irradiation behaviour of fuel cladding and core component materials; Karlsruhe, F. R. Germany (3 Dec 1974).

In European conference on irradiation behaviour of fuel cladding and core component materials.

A study was made of the effects of irradiation temperature and implanted He on the efficiency of the grain size effect in reducing void nucleation and void volume swelling. Results were obtained by 1-MeV electron irradiation of foils of an austenitic stainless steel with and without Al_2O_3 particle dispersions, at 520, 600, and 650°C. (DLC)

7153 (CONF-741232-, pp 57-60) HOT DEFORMATION OF FAST REACTOR FUEL CANS. Anselin, F.; Carteret, Y.; Bataller, S.; Clottes, G.; Mercier, C.; Dupouy, J. M. (CEA-CEN, Fontenay-aux-Roses, Cadarache, Saclay, France). 1974. (In French).

From European conference on irradiation behaviour of fuel cladding and core component materials; Karlsruhe, F. R. Germany (3 Dec 1974).

In European conference on irradiation behaviour of fuel cladding and core component materials.

Experimental results of a series of experiments on the hot deformation of fuel cans are briefly reported. One example of the continuous recording of the diameter of a Fortissimo can irradiated to a fuel burn-up of 18% showed that the hot deformation can be limited to acceptable values. A study on pressurized tubes in Rapsodie shows the presence of a permanent stress much higher than that existing in the fuel cans which increases the swelling but not by an order of magnitude. The presence of a swelling within the depths of a can because of the temperature gradient was qualitatively shown. There is a parallel variation of the C content with the depth in the can thickness. (JSR)

7154 (CONF-741232-, pp 61-64) EFFECT OF MATERIAL AND MATERIAL STATE ON THE VOID FORMATION AND ANNEALING OF THE VOIDS IN AUSTENITIC STEELS. Ehrlich, K.; Raule, G. (Kernforschungszentrum, Karlsruhe, Ger.). 1974. (In German).

From European conference on irradiation behaviour of fuel cladding and core component materials; Karlsruhe, F. R. Germany (3 Dec 1974).

In European conference on irradiation behaviour of fuel cladding and core component materials.

Effects of the chemical composition and the pre-treatment state on the swelling behavior were experimentally studied for three Ti- or Nb-stabilized austenitic steels. The samples were subjected to various thermal processing before irradiation in the Dounreay Fast Reactor. The volume increase was determined as a function of the neutron dose, the annealing duration, and the annealing temperature. Results are shown graphically for the three steels. (JSR)

7155 (CONF-741232-, pp 65-68) STRUCTURE OF FAST REACTOR IRRADIATED SOLUTION TREATED AISI 316 STEEL. Barton, P. J.; Eyre, B. L.; Stow, D. A. (AERE, Harwell, Eng.). 1974.

From European conference on irradiation behaviour of fuel cladding and core component materials; Karlsruhe, F. R. Germany (3 Dec 1974).

In European conference on irradiation behaviour of fuel cladding and core component materials.

Transmission electron microscopy was used to study damage in 316 steel irradiated in DFR to 1 and 3×10^{22} n/cm^{-2} and 430 to 740°C. The structure is described and a quantitative analysis made of the dislocation and void components. (DLC)

7156 (CONF-741232-, pp 69-72) SOME EFFECTS OF FAST REACTOR IRRADIATION ON THE DIMENSIONS OF CLADDING ALLOYS. Watkin, J. S. (UKAEA, Springfields, Eng.). 1974.

From European conference on irradiation behaviour of fuel cladding and core component materials; Karlsruhe, F. R. Germany (3 Dec 1974).

In European conference on irradiation behaviour of fuel cladding and core component materials.

Specimens of M316, FV548, M316L, and PE16 irradiated in DFR were observed to undergo a change in shape at constant volume as well as to exhibit isotropic swelling. The shape change corresponds to a mean reduction in length of 0.2% and an increase in diameter of 0.1%. A similar reduction in length has been observed in specimens cut longitudinally for drawn thick wall tubing. Irradiation in DFR of cold-worked M316 and FV548 and annealed FV548 at 550°C produced a higher void swelling rate than at 407°C but when irradiation at the higher temperature followed a period at the lower temperature the swelling rate remained at a level appropriate to the lower temperature. Irradiation of annealed M316L at 475 or 530°C after a period at 407°C produced swelling which was significantly less than expected if all the irradiation had been at 407°C. Irradiation at 550°C after 407°C resulted in no additional swelling or even slight shrinkage. (auth)

7157 (CONF-741232-, pp 73-76) VOIDS IN HIGH PURITY NICKEL IRRADIATED IN DFR. Brown, C. (UKAEA, Dounreay, Scotland). 1974.

From European conference on irradiation behaviour of fuel cladding and core component materials; Karlsruhe, F. R. Germany (3 Dec 1974).

In European conference on irradiation behaviour of fuel cladding and core component materials.

A transmission electron microscopic examination was carried out on three high-purity Ni samples irradiated in DFR around 600°C to a dose of $\sim 1 \times 10^{22}$ n/cm^2. There was a wide variation in void size, even within the grains themselves. The density change for one sample is 2.07%; void diameters range from 150 to 2000 Å; and some of the voids have coalesced to form clusters as large as 4000 Å. All samples have similar dislocation structures, with a density of 5×10^9 cm/cm^3. (DLC)

7158 (CONF-741232-, pp 77-80) NICKEL-BASED ALLOYS CONTAINING IRON OR SILICON AND HAVING NO SWELLING

UNDER FAST NEUTRON IRRADIATION. Silvestre, G.; Silvent, A.; Regnard, C.; Sainfort, G. (CEA-CEN, Grenoble, France). 1974. (In French).

From European conference on irradiation behaviour of fuel cladding and core component materials; Karlsruhe, F. R. Germany (3 Dec 1974).

In European conference on irradiation behaviour of fuel cladding and core component materials.

The swelling of pure Ni and Ni with 1, 10, and 50 at. % Fe and 0.1, 1, and 8 at. % Si was experimentally studied at 440 to 600°C as a function of neutron flux and temperature. Results are tabulated and the structure evolution is outlined. Alloys with 50 at. % Fe and 8 at. % Si showed no swelling. Mechanisms are discussed. (JSR)

7159 (CONF-741232-, pp 81-83) INFLUENCE OF MINOR ALLOY ADDITIONS ON SWELLING. Smidt, F. A. Jr.; Sprague, J. A.; Westmoreland, J. E.; Malmberg, P. R. (Naval Research Lab., Washington, DC). 1974.

From European conference on irradiation behaviour of fuel cladding and core component materials; Karlsruhe, F. R. Germany (3 Dec 1974).

In European conference on irradiation behaviour of fuel cladding and core component materials.

Pure Ni and its binary alloys with 1 at. % Al, Si, Ti, and Mo were bombarded with 2.8-MeV Ni^+ ions to a damage level of 13 dpa at 525 and 625°C. Results show a high density of voids in pure Ni, a lower density of heterogeneously distributed voids in 1 at. % Al, a few scattered dislocation loops and segments with no voids in 1 at. % Ti, a few dense dislocation tangles sometimes associated with voids in the 1 at. % Si alloy, and no voids and a low dislocation density in 1 at. % Mo. Vacancy trapping at solute atoms is probable. (DLC)

7160 (CONF-741232-, pp 85-88) FORMATION OF VOIDS IN DILUTE ALUMINUM ALLOYS. Mayer, R. M.; Morris, E. T. (Atomic Energy Board, Pretoria, South Africa). 1974.

From European conference on irradiation behaviour of fuel cladding and core component materials; Karlsruhe, F. R. Germany (3 Dec 1974).

In European conference on irradiation behaviour of fuel cladding and core component materials.

Dilute Al–Si and Al–In alloys were irradiated either with electrons in a 750-kV microscope, or with fast neutrons in the SAFARI-I reactor. It was not possible to nucleate voids with electrons. With neutrons, voids were observed in pure Al; their content and size increased with dose. Addition of In enhanced the void formation, while Si suppressed it. 0.2% proof stress was also measured and found to increase with irradiation. (DLC)

7161 (CONF-741232-, pp 89-93) DIMENSIONAL STABILITY OF TANTALUM DURING FAST NEUTRON IRRADIATION. Murgatroyd, R. A.; Bell, I. P.; Bland, J. T. (UKAEA, Risley, Eng.). 1974.

From European conference on irradiation behaviour of fuel cladding and core component materials; Karlsruhe, F. R. Germany (3 Dec 1974).

In European conference on irradiation behaviour of fuel cladding and core component materials.

Results are summarized of an irradiation experiment carried out in DFR to establish the swelling behavior of Ta for temperature and neutron exposure conditions relevant to PFR operation. The transmutation into W explains the dimensional changes. (DLC)

7162 (CONF-741232-, pp 95-98) EFFECTS OF IRRADIATION ON PRECIPITATE STABILITY. Russell, K. C. (Massachusetts Inst. of Tech., Cambridge). 1974.

From European conference on irradiation behaviour of fuel cladding and core component materials; Karlsruhe, F. R. Germany (3 Dec 1974).

In European conference on irradiation behaviour of fuel cladding and core component materials.

Irradiation sometimes produces an unstable phase in alloys, and some mechanisms for this effect are discussed. The effects of vacancies on precipitation of particles which are incoherent with the matrix are extended to irradiation conditions. Annihilation of the vacancies stablizes the particles with a larger atomic volume than the matrix. (DLC)

7163 (CONF-741232-, pp 99-102) EFFECT OF Ni^+-ION IRRADIATION ON PRECIPITATION BEHAVIOUR AND STABILITY OF PRECIPITATES IN INCONEL 625. Vaidya, W. V.; Boehm, H. (Gesellschaft fuer Kernforschung mbH., Karlsruhe, Ger.). 1974.

From European conference on irradiation behaviour of fuel cladding and core component materials; Karlsruhe, F. R. Germany (3 Dec 1974).

In European conference on irradiation behaviour of fuel cladding and core component materials.

Aged Inconel 625 slices were irradiated with 250-keV Ni^+ ions to doses between 10^{15} and 2×10^{17} ions/cm^2 at room temperature. The irradiation caused coarsening of the γ' particles but did not transform it to stable Ni_3(NbMo) phase. It is concluded that recoil dissolution is the dominating process of dissolution under irradiation. (DLC)

7164 (CONF-741232-, pp 103-106) EFFECTS OF IRRADIATION OF γ' PRECIPITATION IN NIMONIC PE16 ALLOY. Sharpe, R. M. (UKAEA, Dounreay, Scotland); Whapham, A. D. 1974.

From European conference on irradiation behaviour of fuel cladding and core component materials; Karlsruhe, F. R. Germany (3 Dec 1974).

In European conference on irradiation behaviour of fuel cladding and core component materials.

Precipitation of γ' as chains and clumps within the grains of fast-neutron irradiated PE16 is due to precipitation on the preferential nucleation sites provided by irradiation damage dislocations and by voids. In solution-treated and aged PE16 irradiated at temperatures below 600°C where thermal coarsening is negligible, the re-distribution of γ' must result from an irradiation re-solution process. Such irradiation re-solution is clearly demonstrated at 530°C where precipitation occurs on grain boundaries after irradiations of 17 and 27 displacements/atom, but not in thermal control specimens. At 530°C the volume fraction which is re-distributed in material with small γ' exceeds that re-distributed in material with large γ', suggesting that the irradiation re-solution process operates more effectively on small precipitates. The precipitation of an additional fine dispersion of γ' in material with large γ' on thermal annealing at 530°C, but the suppression of this precipitation during irradiation is further evidence that the re-solution process operates more effectively on small precipitates. Although the precipitation on the dislocation network can be as high as 2-4% by volume, the size of the background γ' is not changed at 530°C and at 650°C increases only as much as would be expected from the corresponding thermal anneal. This means that the background γ' size reflects the irradiation temperature up to doses of at least 27 displacements/atom. Even when all precipitates are included the sink density only changes by <20%. (DLC)

7165 (CONF-741232-, pp 107-111) APPEARANCE OF MAGNETIC PHASES IN STEELS IRRADIATED BY FAST NEUTRONS. Erler, J. (CEA-CEN, Saclay, France); Faugere, J. L.; Dufayet, J. P.; Marcon, J. P. 1974. (In French).

From European conference on irradiation behaviour of fuel cladding and core component materials; Karlsruhe, F. R. Germany (3 Dec 1974).

In European conference on irradiation behaviour of fuel cladding and core component materials.

The apparent magnetic permeability of a large number of fuel pins was measured along a pin. A typical curve shows two maxima of the magnetic permeability and three anomalies. Two of the anomalies are attributed to the presence of steel or insulating scales in the pin. The characteristics of the first maximum at 530°C is compatible with the hypothesis that the ferromagnetic compound responsable is a $(Fe-Cr)_3C$ carbide precipitated under irradiation. The second maximum appears above 600°C and the magnetism is localized on an external ferrite boundary and an internal boundary contiguous to the zone of reaction with the fuel. The third anomaly corresponds to an integranular lattice of a ferromagnetic phase. (JSR)

7166 (CONF-741232-, pp 113-116) THEORY OF DISLOCATION CREEP FOR A MATERIAL SUBJECTED TO BOMBARDMENT BY ENERGETIC PARTICLES: ROLE OF THERMAL DIFFUSION. Gittus, J. H. (UKAEA, Springfields, Eng.). 1974.

From European conference on irradiation behaviour of fuel cladding and core component materials; Karlsruhe, F. R. Germany (3 Dec 1974).

In European conference on irradiation behaviour of fuel cladding and core component materials.

The equation for the irradiation creep of a material subjected to bombardment by energetic particles which was developed from continuum mechanics arguments in an earlier paper (Phil. Mag. 23:393 (1973)) is now derived independently from a dislocation model. This reduces the unknowns in the creep-equation from two to one. The model, which examines the balance between hardening and recovery, is one which has recently been found to give a reasonable fit to thermal creep data. Its use enables predictions to be made for the irradiation creep rate at around half the absolute temperature of melting. Quite good agreement is found with irradiation-creep data, particularly for Zircaloy 2. The equation is used to define the boundaries between irradiation-creep, dislocation-creep, and diffusion-creep on a relaxation-time map for stainless steel. (auth)

7167 (CONF-741232-, pp 117-121) EFFECT OF THE TEXTURE ON THE DEFORMATION RATE SHOWN BY ZIRCONIUM ALLOYS IN A REACTOR. de Montpreville, C. T. (CEN, Saclay, France). 1974. (In French).

From European conference on irradiation behaviour of fuel cladding and core component materials; Karlsruhe, F. R. Germany (3 Dec 1974).

In European conference on irradiation behaviour of fuel cladding and core component materials.

The general equations for the deformation of a polycrystal were derived and a program written in APL was used for their solution. The creep and growth of polycrystals of Zr alloys with its (00.1) axes parallel to a reference axis were calculated. The program was applied to thin tubes stressed monoaxially and biaxially. The consideration of the texture in expressions for Cottrell creep explains previously incomprehensible singularities in the growth and creep of Zr alloys. (JSR)

7168 (CONF-741232-, pp 123-126) DOSE DEPENDENCE OF IRRADIATION CREEP OF ZIRCALOY-2. Wood, D. S. (UKAEA, Risley, Eng.). 1974.

From European conference on irradiation behaviour of fuel cladding and core component materials; Karlsruhe, F. R. Germany (3 Dec 1974).

In European conference on irradiation behaviour of fuel cladding and core component materials.

Diameter measurements carried out on SGHWR pressure tubes extend to durations of 22,000 h and can be treated statistically. Results can be expressed as a function of dose and the creep strain can be expressed equally well by two relationships, one involving a linear correlation with the dose and the other involving a term of dose to the power of 0.6. Long-term predictions indicate that in 30 years the SGHWR pressure tube creep strains are likely to be 1 to 3%. The creep strains observed on many tubes from one supplier show very little scatter. A significant difference was however observed in the creep behaviour of tubes obtained from two different suppliers. This difference is attributed to differences in texture resulting from differences in the tube manufacturing route. (auth)

7169 (CONF-741232-, pp 127-130) ANALYSIS AND VERIFICATION OF CREEP COLLAPSE OF ZIRCALOY-4 FUEL CLADDING. Yoon, K. E. (Babcock and Wilcox Co., Lynchburg, VA). 1974.

From European conference on irradiation behaviour of fuel cladding and core component materials; Karlsruhe, F. R. Germany (3 Dec 1974).

In European conference on irradiation behaviour of fuel cladding and core component materials.

An analytical method based on W. K. Wilson's method for creep-buckling of tubes under external pressure (WAPD-TM-956), is presented. This method and the CROV computer code is verified against experimental creep collapse data for Fr-4 cladding at 343 and 371°C both in- and ex-reactor at three pressure differentials.

7170 (CONF-741232-, pp 131-134) IRRADIATION CREEP: CONSEQUENCES FOR THE CASING TUBE. Balloffet, Y.; Blanchard, P.; Huillery, R.; Languille, A.; Dupouy, J. M. (CEA-CEN, Cadarache, France). 1974. (In French).

From European conference on irradiation behaviour of fuel cladding and core component materials; Karlsruhe, F. R. Germany (3 Dec 1974).

In European conference on irradiation behaviour of fuel cladding and core component materials.

One of the consequences of irradiation creep of the casing tube is that the flat sides of the hexagon might bulge under the effect of the pressure difference between the Na inside and outside the casing. Theoretical and experimental evaluations were made of the extent of this phenomenon. Results were in good agreement except that the position of the maximum of the deformation amplitude do not coincide. (JSR)

7171 (CONF-741232-, pp 135-138) IRRADIATION-INDUCED CREEP OF COLD-WORKED AUSTENITIC STAINLESS STEELS. Bergmann, H. J. (INTERATOM, Germany); Capart, G.; Dietz, W. 1974.

From European conference on irradiation behaviour of fuel cladding and core component materials; Karlsruhe, F. R. Germany (3 Dec 1974).

In European conference on irradiation behaviour of fuel cladding and core component materials.

The experimental data after one irradiation campaign show the occurence of irradiation-induced creep. The quantitative results are consistent with the predictions based on the current design formula. The linear dependence of creep deformation on stress seems well accounted for by the experimental points. In addition, no significant temperature dependence can be inferred from the results. (DLC)

7172 (CONF-741232-, pp 139-142) DFR IRRADIATION CREEP EXPERIMENTS: PROGRESS WITH OLD AND NEW INVESTIGATIONS. Mosedale, D.; Lewthwaite, G. W.; Ramsay, I. (UKAEA, Dounreay, Scotland). 1974.

From European conference on irradiation behaviour of fuel cladding and core component materials; Karlsruhe, F. R. Germany (3 Dec 1974).

In European conference on irradiation behaviour of fuel cladding and core component materials.

Irradiation creep of Nimonic PE16 to higher damage levels is reported. First results of an investigation of the dependence of irradiation creep on the stress system are outlined. Some results are also given for cold-worked type 347 stainless steel. It is concluded that the Soderberg formalism gives a good explanation of the results if a correction for Buckley growth is made. (DLC)

7173 (CONF-741232-, pp 143-146) EXPERIMENTAL STUDY ON THE RADIO-INDUCED CREEP OF STABILIZED STEELS. Closs, K. D.; Herschbach, K.; Schneider, W. (Kernforschungszentrum, Karlsruhe, Ger.). 1974. (In German).

From European conference on irradiation behaviour of fuel cladding and core component materials; Karlsruhe, F. R. Germany (3 Dec 1974).

In European conference on irradiation behaviour of fuel cladding and core component materials.

Radio-induced creep of three stabilized austenitic steels, irradiated in the BR-2 at temperatures between 240 and 450°C, was measured as a function of neutron dose, temperature, and stress. The linear dependence of the normalized creep deformation on the neutron dose was confirmed. No temperature dependence for radioinduced creep could be detected. There was a linear relation between creep rate and stress. (JSR)

7174 (CONF-741232-, pp 151-154) IN-REACTOR CREEP RELAXATION OF FAST REACTOR FUEL CLADDING ALLOYS. Standring, J. (UKAEA, Springfields, Eng.). 1974.

From European conference on irradiation behaviour of fuel cladding and core component materials; Karlsruhe, F. R. Germany (3 Dec 1974).

In European conference on irradiation behaviour of fuel cladding and core component materials.

Springs of stainless steels M316 and FV548 and Nimonic PE16 were irradiated in the DFR reflector at 300°C. Effects of stress, composition, dose, and annealing recovery were studied. (DLC)

7175 (CONF-741232-, pp 155-157) GRAIN BOUNDARIES AS VACANCY SOURCES DURING THE GROWTH OF VOIDS AND GAS BUBBLES. Harris, J. E. (Berkeley Nuclear Labs., Eng.). 1974.

From European conference on irradiation behaviour of fuel cladding and core component materials; Karlsruhe, F. R. Germany (3 Dec 1974).

In European conference on irradiation behaviour of fuel cladding and core component materials.

A suitable dispersion of intergranular precipitation can prevent radioinduced embrittlement in metals and alloys. The mechanism for this inhibition is discussed and a relation presented for calculating the size and spacing of the precipitation necessary to inhibit void growth. (DLC)

7176 (CONF-741232-, pp 159-163) EFFECT OF HIGH He CONTENT (400 TO 500 PPM) ON THE MECHANICAL PROPERTIES OF HASTELLOY-X AT HIGH TEMPERATURES. Boehm, H.; Wassilew, C. (Kernforschungszentrum, Karlsruhe, Ger.). 1974. (In German).

From European conference on irradiation behaviour of fuel cladding and core component materials; Karlsruhe, F. R. Germany (3 Dec 1974).

In European conference on irradiation behaviour of fuel cladding and core component materials.

The effect of high He content on the mechanical properties of two Hastelloy-X samples subjected to different preliminary processing and irradiated at 650°C up to neutron fluxes of 1.4×10^{22} n/cm^2 (E > 0.1 MeV) and 1.04×10^{22} n/cm^2 (thermal) was studied. The dependence of the embrittlement on the temperature and stretching rate was determined for irradiated and non-irradiated samples. Results showed little or no dependence of the embrittlement on the He content. (JSR)

7177 (CONF-741232-, pp 165-168) DISPERSION-STRENGTHENED FERRITIC ALLOYS AND AUSTENITIC STAINLESS STEELS EMBRITTLEMENT AFTER IRRADIATION UP TO 10^{22} n/cm^2 BETWEEN 500 AND 700°C. Van Asbroeck, P.; Vandermeulen, W.; Cheema, S. U.; Huet, J. J.; Van de Velde, J. (CEN/SCK, Mol, Belgium). 1974.

From European conference on irradiation behaviour of fuel cladding and core component materials; Karlsruhe, F. R. Germany (3 Dec 1974).

In European conference on irradiation behaviour of fuel cladding and core component materials.

Tensile properties were measured for the following irradiated iron alloys: 12.6 Cr–2.05 Mo–6.47 Ti–1.640, 13 Cr–1.5 Mo–3.5 Ti, 14.4 Cr–1.17 Mo–13.1 Ni–0.49 Ti, and AISI 316. Results are discussed. (DLC)

7178 (CONF-741232-, pp 169-172) EFFECT OF NEUTRON IRRADIATION ON THE TIME STABILITY AND CREEP BEHAVIOR OF VARIOUS Ti-STABILIZED AUSTENITIC STEELS. Wassilew, C.; Schirra, M. (Kernforschungzentrum, Karlsruhe, Ger.). 1974. (In German).

From European conference on irradiation behaviour of fuel cladding and core component materials; Karlsruhe, F. R. Germany (3 Dec 1974).

In European conference on irradiation behaviour of fuel cladding and core component materials.

The effect of reactor irradiation on the mechanical properties of three Ti-stabilized austenitic steels was studied. Results showed that the time stability after irradiation clearly depends on the chemical composition of the steel and the irradiation temperature and possibly on the pre-processing conditions. The time stability of the steels before and after irradiation was determined at 650°C. A decrease in stability was observed for two of the steels. The fracture expansion of the steels was determined before and after irradiation. (JSR)

7179 (CONF-741232-, pp 173-176) MECHANICAL BEHAVIOR OF JACKETS OF THE AUSTENITIC STEEL X8 CrNiMoVNb 1613 IN VARIOUS IRRADIATION EXPERIMENTS. Schaefer, L. (Kernforschungszentrum, Karlsruhe, Ger.); Closs, K. D.; Bergmann, H. J.; Dietz, W. 1974. (In German).

From European conference on irradiation behaviour of fuel cladding and core component materials; Karlsruhe, F. R. Germany (3 Dec 1974).

In European conference on irradiation behaviour of fuel cladding and core component materials.

The results of irradiation studies in the Br-2, Dounreay Fast Reactor, and Rapsodie reactor on the suitability of this steel as a fuel jacket in fast reactors and on the effects of irradiation on the tensile properties were reported. The yield points and homogeneous expansion were determined as a function of the irradiation temperature and the fast neutron dose. The creep rate was determined as a function of the corrosion-corrected tangential stress. These results are shown graphically. (JSR)

7180 (CONF-741232-, pp 177-180) IRRADIATION OF CARBIDES OF URANIUM AND PLUTONIUM WITH SODIUM JOINT: CARBURIZATION OF THE CLADDINGS. Mikailoff, H.; Housseau, M.; Erler, J. (CEA, Fontenay-aux-Roses, France). 1974. (In French).

From European conference on irradiation behaviour of fuel cladding and core component materials; Karlsruhe, F. R. Germany (3 Dec 1974).

In European conference on irradiation behaviour of fuel cladding and core component materials.

The carburization of stainless steel claddings of (U–Pu)C fuel with a sodium joint under the influence of reactor irradiation was studied. Micrographic examinations, chemical analysis, mechanical tests, and microhardness measurements of steel claddings irradiated under different conditions clearly showed the carburization of the steel claddings. Results indicated that the transfer of C occurs preferentially toward the hottest part of the cladding and that irradiation probably accelerates the diffusion of carbon in the steel. (JSR)

7181 (CONF-741232-, pp 181-184) RESULTS OF THE SECOND INTERIM EXAMINATION (AT APPROX. 50,000 MWD/Te BURNUP) OF THE F-1 (X094) HIGH-TEMPERATURE FUEL-ROD IRRADIATION EXPERIMENT IN EBR-II. Lindgren, J. R.; Weinberg, A. F.; Flynn, P. W.; Neimark, L.; Strain, R. 1974.

From European conference on irradiation behaviour of fuel cladding and core component materials; Karlsruhe, F. R. Germany (3 Dec 1974).

In European conference on irradiation behaviour of fuel cladding and core component materials.

F-1 (X094) is the first experiment in the fuel irradiation program for the GCFR. The fuel rods are 20% cold-worked Type 316 stainless steel-clad mixed oxide. Diametral changes, fission-product attack, and creep-rupture tests on the cladding are reported. (DLC)

7182 (CONF-741232-, pp 185-188) EFFECT OF NEUTRON IRRADIATION AND HYDROGEN ON THE DUCTILITY OF ZIRCALOY FUEL CLADDING TUBES. Mishima, Y. (Tokyo Univ.); Okubo, T.; Abe, K. 1974.

From European conference on irradiation behaviour of fuel cladding and core component materials; Karlsruhe, F. R. Germany (3 Dec 1974).

In European conference on irradiation behaviour of fuel cladding and core component materials.

The effects of irradiation and hydrogen on circumferential and longitudinal ductilities of Zircaloy-2 and -4 tubes were studied using small cupon specimens that were hydrided to about 200 ppm H and irradiated up to 10^{21} nvt (>1 MeV). The specimens were irradiated in the JMTR at a coolant temperature of 40 to 50°C. Post-irradiation examinations included flattening, hardness testing, ring and longitudinal tensile testing, flare testing, microstructure, hydride orientation, and ductility testing. (SFL)

7183 (CONF-741232-, pp 189-192) EFFECTS OF BOILING WATER REACTOR IRRADIATION ON TENSILE PROPERTIES OF ZIRCALOY. Williams, C. D. (General Electric Co., San Jose, CA); Adamson, R. B.; Olshausen, K. D. 1974.

From European conference on irradiation behaviour of fuel cladding and core component materials; Karlsruhe, F. R. Germany (3 Dec 1974).

In European conference on irradiation behaviour of fuel cladding and core component materials.

This work showed that some inhomogeneous strain characteristics previously reported for irradiated alpha-annealed Zircaloy are modified in weld- or beta-quenched material. This behavior is attributed to microstructural differences, viz. texture and grain form. In addition it is shown that conventional measurements of plastic strain do not provide a true indication of the strain capacity of irradiated structural components. (8 fig) (auth)

7184 (CONF-750703-3) DEFECT–IMPURITY INTERACTIONS IN IRRADIATED GERMANIUM. Cleland, J. W. (Oak Ridge National Lab., Tenn. (USA)). 1972. 4p. Dep. NTIS $4.00.

From IEEE annual conference on nuclear and space radiation effects; Areata, California, USA (14 Jul 1975).

N-type samples of Ge containing approximately 2 to 5 x 10^{15} or 2 to 5 x 10^{16} P, As, Sb, or O_4 clusters cm^{-3} were irradiated at approximately 300°K with thermal neutrons, and the apparent rate of removal of conduction electrons was determined as a consequence of lattice defects introduced by (n,gamma) recoils. The rate of introduction of lattice defects was larger for P and As than for Sb-doped Ge, and increased slightly for Ge with a larger initial impurity concentration. There was no electrical evidence for multiple defect creation, or for any (VO) type defect state. However, the rate of introduction of lattice defects was less by a factor of three for n-type Ge in which the donor concentration was due to O_4 clusters. Hiraki and Fukunaga [Defects in Semiconductors, (Reading, 1972) 335] suggested that the radiation resistance of Si or Ge p-n devices might be improved by the use of oxygen clusters to provide donors instead of conventional impurities, and these data are in general agreement with their observations. (auth)

7185 (COO-2459-1) REPORT OF THE APS SUMMER STUDY ON PHYSICS PROBLEMS RELATING TO ENERGY TECHNOLOGIES: RADIATION EFFECTS ON MATERIALS. Vook, F. L.; Birnbaum, H. K.; Blewitt, T. H. (Sandia Labs., Albuquerque, N. Mex. (USA); Illinois Univ., Urbana (USA); Argonne National Lab., Ill. (USA)). Jun 1974. 122p. Dep. NTIS $9.25.

The status of research and development programs related to radiation effects on materials is reviewed. Information is included on point defects in metals, dislocations, radiation damage, simulation of neutron damage, H and He in metals, insulators, semiconductors, and superconductors. (JRD)

7186 (HEDL-SA-785) SWELLING IN NEUTRON IRRADIATED NICKEL-BASE ALLOYS. Brager, H. R.; Bell, W. L. (Hanford Engineering Development Lab., Richland, Wash. (USA)). 1972. Contract AT(45-1)-2170. 3p. (CONF-750607-2). Dep. NTIS $4.00.

From American Nuclear Society meeting; New Orleans, Louisiana, USA (8 Jun 1975).

Inconel 625, Incoloy 800 and Hastelloy X were neutron irradiated at 500 to 700°C. It was found that of the three alloys investigated, Inconel 625 offers the greatest swelling resistance. The superior swelling resistance of Inconel 625 relative to that of Hastelloy-X is probably related to differences in the concentrations of the minor rather than major alloy constituents and can involve (a) enhanced recombination of defects in the Inconel 625 and (b) preferential attraction of vacancies to incoherent precipitates. (auth)

7187 (KAPL-P-4022) EFFECT OF RADIATION ON THE DEFORMATION AND FRACTURE OF STRUCTURAL ALLOYS. Lacy, C. E. (Knolls Atomic Power Lab., Schenectady, N. Y. (USA)). Mar 1975. Contract W-31-109-ENG-52. 20p. (CONF-750442-1). Dep. NTIS $4.00.

From seminar on the role of environment on deformation and fracture; Hudson, New York, USA (21 Apr 1975).

The effects of radiation on reactor materials are described. Information and discussions are included on mechanisms of radia-

tion damage, general effects of radiation on alloy properties, effects of radiation on stainless steel, and effects of radiation on reactor vessel steels. (JRD)

7188 (KFK-1274/3, pp vp) MATERIAL STUDIES AND DEVELOPMENT. Schaefer, L.; Schirra, M. Dec 1974. (In German).

12 figs.; 1 tab.; 2 refs.

In 3rd quarter annual report 1974. (Kernforschungszentrum Karlsruhe (F. R. Germany). Projekt Schneller Brueter).

Results regarding the dependence on neutron dose and temperature of the creep of cladding materials are discussed in the light of in-pile experiments of the Mol 5B series. Results from the DFR 397 in-pile test are available on the swelling behavior of austenitic steels after various kinds of preliminary treatment. They seem to indicate a considerable reduction of swelling in the cold-worked condition and a particularly advantageous behavior of 1.4970 type steel. (auth)

7189 (RD/B/N-3284) MEASUREMENT OF VOID SWELLING BY TRANSMISSION ELECTRON MICROSCOPY. Fisher, S. B.; Buswell, J. T. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Jan 1974. 13p. Dep. NTIS (US Sales Only) $4.00.

The estimation of void swelling by transmission microscopy of irradiated materials is reviewed. In the interests of accuracy and uniformity among users, certain recommendations are made concerning the choice of parameters for the description of swelling. A recommended procedure for the measurement of void volume, void density, and total swelling is outlined. (auth)

7190 (SAND-74-0190) CALORIMETRIC DETERMINATION OF ENERGY DEPOSITION BY ELECTRONS IN TANTALUM AND LAYERED MEDIA Miller, G. H.; Lockwood, G. J. (Sandia Labs., Albuquerque, N. Mex. (USA)). Sep 1974. Contract AT(29-1)-789 40p. Dep. NTIS $5.00.

The continuation and extension of a program previously reported, in which a square-wave beam modulation technique, utilizing the time-derivative of the calorimeter temperature, had been developed and applied to electron energy deposition measurements in aluminum are described. The method was applied to tantalum and to layered media. This led to additional problems associated with materials having low thermal conductivity and high emissivity. It was found that the calibration changed with the input power level and that there was thermal radiation coupling between the front foil and calorimeter. The study of, and solution to, these problems led to a significantly improved data analysis system. Data are presented for normal incidence on tantalum at 1.0, 0.5, and 0.3 MeV. Measurements were also made for normally incident electrons at 1.0 and 0.5 MeV for a system consisting of 5×10^{-3} cm tantalum followed by a thick layer of aluminum. (auth)

7191 (TID/SNA-2112) NUCLEAR ROCKET MATERIALS PROGRAM. Lombardo, J. J.; Funk, C. W. (Aerojet-General Corp., Sacramento, Calif. (USA)). 1968. 8p. Dep. NTIS $4.00.

The Nuclear Rocket Program has contributed a number of significant developments to materials technology. Irradiated ball-bearing retainers of polybenzimidazole bonded glass have been successfully operated in liquid hydrogen for three hours at 24,000 rpm with a 1200-pound thrust load. Solution-hardened iron and nickel-base alloys have demonstrated resistance to thermal-neutron radiation damage 10^{19} nvt without the ductility loss noted in precipitation-hardened alloy systems. Radiation damage of beryllium and graphite has decreased electrical and thermal conductivity at cryogenic temperature. Beryllium has been classified as a brittle alloy at cryogenic temperature when irradiated at 10^{18} nvt (fast); however, fracture mechanics data were generated to enable application of this in design of reactor components. Nickel-base austentic alloys have been cold-worked and age-hardened to exhibit 330,000 psi yield strength at −320°F without significant ductility loss. The recently developed high-strength weldable 7039 aluminum has been evaluated for radiation damage at cryogenic temperatures and found to provide elongation greater than 10% when exposed to 2×10^{17} nvt (fast). It has been demonstrated that P-03 graphite will not adhere in 10^{-10} torr vacuum. The largest Hastelloy X forgings in the United States and the welding of heavy sections of Hastelloy X constituted significant advances in the state of high-temperature alloy casting, forging, and fabricating. New management techniques to improve the reliable application of materials have been evolved from the joining of aerospace and nuclear engineering experience. (auth)

7192 (TID/SNA-2123) CRYOGENIC RADIATION EFFECTS ON NERVA STRUCTURAL ALLOYS. Dixon, C. E.; Stadig, J. E.; Funk, C. W. (Aerojet-General Corp., Sacramento, Calif. (USA)). 1968. 28p. Dep. NTIS $4.50.

This investigation extended the basis for determination of design properties of alloys used at cryogenic temperatures in the NERVA nuclear propulsion engine. To provide the additional data required, ten commercial alloys, in 23 conditions, were irradiated and tensile tested in liquid nitrogen to neutron fluences of approximately 10^{18} nvt (E > 1.0 MeV), at the General Dynamics GTR reactor. Alloys tested included Hastelloy X, Inconel 625, Inconel 718, Udimet 630, Waspaloy, A-286, Al 7075, Al 7038, Al 6061, and Ti 5Al−2.5 Sn ELI. The materials exhibited significant increases in 0.2% offset yield strength and notched tensile strength, minor increases in ultimate tensile strength, and decreases in elongation that varied in significance. An exception to these results was a 25% decrease in notched strength for Ti 5Al−2.5Sn ELI. (auth)

7193 EFFECT OF CONDITION OF RECRYSTALLIZATION HEAT TREATMENT ON HIGH TEMPERATURE MECHANICAL PROPERTIES OF AN IRRADIATED AISI 316 AUSTENITIC STEEL. Kawasaki, S.; Hishinuma, A. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). J. Nucl. Sci. Technol. (Tokyo); 11: No. 11, 505-509(Nov 1974).

A study was made of radiation-induced high-temperature embrittlement of AISI 316 austenitic steel. Cold worked specimens were recrystallized at temperatures 950 ~ 1100°C held for periods ranging 2 ~ 60 min. The specimens were then irradiated to 1.7×10^{21} nvt (>1 MeV) at 55°C after which they were subjected to tensile testing at 650°C. In the specimens recrystallized at 950°C, carbide precipitation was observed to have occurred, and these specimens were found less liable to show radiation-induced embrittlement. On the other hand, specimens recrystallized at 1025 and 1100°C became completely solution treated, and exhibited severe radiation-induced embrittlement. It is surmised that the carbides precipitated on the grain-boundaries tend to inhibit propagation of grain-boundary cracks, and hence contribute to lessening radiation-induced embrittlement. (JA)

7194 EQUATION OF STATE OF STRUCTURALLY-STABLE STAINLESS STEEL IN A HIGH-INTENSITY FIELD OF RADIATION. Kiselevskii, V. N.; Polevoi, D. V.; Yudin, O. N.; Kosov, B. D. (Inst. of Strength Problems, Kiev). Strength Mater.; 6: No. 7, 814-817(Jul 1974).

Translated from Probl. Prochnosti; 6: No. 7, 30-33(Jul 1974).

A phenomenological equation is presented for the initial parts of the creep curves of irradiated structurally-stable steel, providing a quantitative estimate of the creep deformation based on a limited number of experimental data for gradually varying levels of the effective stress. The first experimental verification of the equation has revealed excellent agreement with the actual deformation of irradiated Kh16N15M3B steel. (auth)

7195 FIELD-ION MICROSCOPE OBSERVATIONS OF SPUTTERED TUNGSTEN SURFACES. Walls, J. M. (Univ. of Aston, Birmingham, Eng.); Braun, E.; Southworth, H. N. Jap. J. Appl. Phys.; No. Suppl. 2, 355-358(1974).

From 6th international vacuum congress; Kyoto, Japan (25 Mar 1974). See CONF-740353.

Low energy ion bombardment is an essential preliminary to much surfaces research as a means of producing a chemically clean surface. Hence it is important to know the nature and distribution of the resultant lattice damage, and the extent to which it may be removed by subsequent annealing. The field-ion microscope proves to be an ideal technique for investigating such damage since its characterization lies on the atomic scale. The study is concerned with the in situ sputtering of tungsten emitters using neon, argon, and xenon ions with energies in the range 100 eV to 1 keV, together with observations of the effect of annealing. The relevance of these results to surface cleaning schedules is discussed. (auth)

7196 METHOD OF ESTIMATING THE LONG-TERM STRENGTH OF AN IRRADIATED REFRACTORY STEEL. Kiselevskii, V. N.; Polevoi, D. V. (Inst. of Strength Problems, Kiev). Strength Mater.; 6: No. 6, 720-721(Jun 1974).

Translated from Probl. Prochnosti; 6: No. 6, 65-66(Jun 1974).

A method for estimating long-term strength of irradiated stainless steel is described. Application of this method, based on calculated values, is the basis for shortened in-reactor investigations aimed at determining the lifetime of irradiated steels. (JRD)

7197 DECHANNELING BY HYDROGEN IN PALLADIUM. Jousset, J. C.; Mory, J.; Quillico, J. J. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Section d'Etude des Solides Irradies). J. Phys. (Paris), Lett.; 35: No. 11, L229-L231(Nov 1974). (In French).

The dechanneling yield of alpha particles by hydrogen atoms dissolved in palladium was measured. The dechanneling cross-section is found equal to $(5.7 \pm 2.6)10^{-3}$ A^2. This effect is attributed to the obstruction of the channels by the protons. A calculation was performed to evaluate theoretically the value of the

dechanneling cross-section. The obstruction is described by a Coulomb interaction between an alpha particle and a proton. The probability for a channeled particle to be scattered out of its channel is calculated. The dechanneling cross-section is deduced in the two extreme cases of a free proton: 3×10^{-3} A² and of a bound proton: 12×10^{-3} A². These two values are in good agreement with the experimental value. (FR)

7198 IONIZATION CROSS SECTION FOR THE L_{23} LAYER OF ALUMINIUM IN AN Ne^+–Al COLLISION. Benazeth, C.; Viel, L. (Toulouse-3 Univ., 31 (France). Lab. de Physique des Solides). Compt. Rend., Ser. A, B; 279: No. 14, 349-352(30 Sep 1974). (In French).

The variation of the ionization cross section of the L_{23} layer of aluminium in an Ne^+–Al collision was studied as a function of the incident particle energy, using Auger spectroscopy. The results are interpreted in the framework of the electron promotion model of Fano and Lichten, and compared to the theoretical expression given by Cacak. (FR)

7199 BORDONI RELAXATION OF ALUMINIUM IRRADIATED WITH NEUTRONS, THEN HARDENED AT LOW TEMPERATURE. Esnouf, C.; Fantozzi, G.; Gobin, P. F. (Institut National des Sciences Appliquees (INSA), 69 - Villeurbanne (France)). Mem. Sci. Rev. Metall.; 71: No. 10, 637-645(Oct 1974). (In French).

From autumn meeting on metallurgy; Paris, France (1 Oct 1973).

The influence of a neutron irradiation at 80K, carried out before strain-hardening, on the anelastic properties of 99.999% aluminium was studied. By decomposition of the relaxation spectrum of two main peaks representing the Bordoni relaxation spectrum can be followed, the B_1 peak at about 60K and the B_2 peak around 90K. Following a small irradiation dose (2.10^{16}N/cm²) and immediately after strain-hardening the B_2 peak predominates and the B_1 peak only develops during annealing. After a strong dose of irradiation (10^{18}N/cm²) the lower B_2 peak predominates and no appreciable B_1 development is observed during annealing. Moreover when the degree of strain-hardening is small a strong diffuse maximum appears at about 115K after annealing towards room temperature, the B_2 peak seeming to disappear. The results can be interpreted coherently from Bordoni's relaxation model based on the heat-activated formation of double disconnections. (FR)

7200 MAGNETIC ANALYSIS OF RADIATION ENHANCED DIFFUSION IN FERROMAGNETIC NICKEL–BERYLLIUM ALLOYS. Bisswanger, H.; Sizmann, R. (Univ., Munich). Radiat. Eff.; 24: No. 2, 79-87(1975).

5 μm foils of supersaturated ferromagnetic nickel-14.3 at. % beryllium have been irradiated at various temperatures between 120 and 200°C by 50 to 200 μA/cm² electrons at 2.5 MeV. The precipitation of beryllium induced by the irradiation is determined from the variation of the magnetization vs. temperature curves with dose. The magnetic analysis yields the differential variation of the dissolved beryllium per beryllium concentration interval. Above 160°C the measurements show a linear dependence of the apparent radiation enhanced diffusion coefficient on the defect production rate and no effect on temperature variation. At lower temperatures the enhanced diffusion increases less steeply than linearly with the flux density and slightly with temperature. This behavior turns up practically in any concentration region. (auth)

Other Materials

Refer also to abstracts 5995, 6001, 6570, 7002, 7059, 7089, 7185, 8047, and 8049.

7201 (AD-767221) EVALUATION OF TEST TECHNIQUES FOR ADVANCED COMPOSITE MATERIAL. Technical Report, 10 July 1967–31 May 1970. Lenoe, E. M. (Avco Systems Div., Wilmington, Mass. (USA)). Aug 1971. Contract F33615-67-C-1719. 306p. NTIS $7.00.

Tentative test methods are presented for evaluating the tension, flexure, and shear behavior of boron epoxy composites. These methods are based upon fairly extensive studies of the influence of specimen geometry and experimental techniques. Non-destructive evaluation procedures are also discussed. Limited information is included concerning the thermal expansion response of nominal 50 volume percent boron laminates. Comparisons are made of data obtained using sandwich beam and cylinder experiments and coupon test specimens. A special cylinder test fixture was used wherein the ends of the thin walled tubes were restrained with a rubber bladder in order to minimize specimen end restraint effects. The report also includes a discussion of the adequacy of the recommended test methods for other advanced composite systems. (GRA)

7202 (AED-CONF-74-089-022) INFLUENCE OF ION BOMBARDMENT ON THE THERMOELECTRIC FORCE OF AMORPHOUS Ge. Beyer, W.; Kroemer, G.; Stuke, J. (Marburg Univ. (F. R. Germany). Fachbereich Physik). 1974. 7p. (In German). INIS.

From spring meeting of the Arbeitskreis Festkoerperphysik of the Deutsche Physikalische Gesellschaft e.V.; Freudenstadt, F. R. Germany (1 Apr 1974).

Amorphous Ge layers were bombarded with He^+ ions in order to investigate the influence of foreign atoms as compared to defects which always occur in bombardment. A different behavior is obtained than in the implantation with reactionable atoms. The hopping conductivity is also increased by bombardment, but the thermoelectric force remains positive in the activated region; it only becomes smaller. By annealing at the same temperature as prior to the bombardment, the original properties of the layer can be practically reproduced. Thus the Fermi level remains in this case in the lower half of the forbidden zone. (GE)

7203 (AED-CONF-74-328-028) THE INFLUENCE OF IRRADIATION CONDITIONS ON THE ACCUMULATION AND PROPERTIES OF RADIATION DEFECTS. Bolotov, V. V.; Vasiljev, A. V.; Panov, V. I.; Smirnov, L. S. (AN SSSR, Novosibirsk. Inst. Fiziki Poluprovodnikov). 1974. 7p. INIS.

From international conference on lattice defects in semiconductors; Freiburg im Breisgau, F. R. Germany (22 Jul 1974).

3 figs.; 17 refs. With abstract. Available from ZAED.

Different experimental results of the radiation defect formation in semiconductors were studied. The results on germanium and silicon demonstrate the fact that the irradiation temperature or intensity variation resulted in the change of defect complexes dominating in influencing the properties of irradiated crystals. The increasing irradiation intensity (i.e., the ionization in crystal) is accompanied by the rising and subsequent saturation of some kinds of defects (for instance vacancy-donor association in germanium). The comparison of the irradiation influence by direct and pulsed electron beam gives the dependence of the introduction rates of complexes and, in particular, allows one to estimate in germanium the vacancy energy for migration. The magnitude of this energy proves to be less than 0.01 eV. The high temperature irradiation is shown to be the method of high stable radiation defect production. Besides, the irradiation temperature role seems to increase because the displacement energy for production of Frencel pairs is sharply decreased with the rising of temperature. A generalized and experimentally verified model of the reactions in crystals under irradiation and annealing is presented. (GE)

7204 (CEA-CONF-2800) ION IMPLANTATION IN FERRIMAGNETIC GARNETS. Jouve, H.; Gailliard, J. P.; Piaguet, J. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Lab. d'Electronique et de Technologie de l'Informatique). 5 Sep 1974. 10p. (In French). INIS.

From 4th international congress AVISEM 74. Application of electronic and ionic processes; Toulouse, France (8 Oct 1974).

Ion implantation in thin films of ferrimagnetic garnets is shown to create stresses sufficient to make the magnetization to tilt from a direction perpendicular to the plane of the plate to a direction parallel to this plane. The tilting occurs according to a stress profile depending upon the dose, and the energy and nature of the ions. Beyond a certain dose, the material structure is transformed into a nonmagnetic disordered structure. The values for the magnetorestriction coefficient and the anisotropy energy for growth, condition the possibility for the magnetization to tilt. (FR)

7205 (DP-MS-75-8) NEPTUNIUM TETRABROMIDE: A MOESSBAUER AND MAGNETIC SUSCEPTIBILITY STUDY BELOW 20^0K. Stevens, J. L.; Jones, E. R. Jr.; Stone, J. A.; Karraker, D. G. (South Carolina Univ., Columbia (USA); Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.). 1974. Contract AT(07-2)-1. 9p. (CONF-750427-3). Dep. NTIS $4.00.

From meeting of the American Physical Society; Washington, District of Columbia, USA (28 Apr 1974).

$NpBr_4$ was studied by ^{237}Np Moessbauer resonance from 4.2 to 20^0K and by vibrating-sample magnetometer from 2.2 to 70.5^0K. The magnetic susceptibility exhibits typical Curie–Weiss behavior about 20^0K and displays a sharp peak at 12.5 ± 0.5^0K indicating an antiferromagnetic transition. The Moessbauer spectrum at 4.2^0K agrees with previous work by Stone and Pillinger [J. A. Stone and W. L. Pillinger, Sym. Faraday Soc. 1: 77(1967)]. At approximately 13^0K, there is a small decline in H/sub eff/ with paramagnetic relaxation effects remaining at higher temperatures. (auth)

7206 (IC-74-82) ELECTRIC-FIELD-INDUCED TWO-PHOTON ABSORPTIONS IN SOLIDS. Hassan, A. R.; Mousa, A. R. (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1974. 14p. INIS.

The influence of an electric field on the two-photon interband transitions has been investigated. Expressions for the absorption coefficients at the critical points M_0 and M_1 have been derived adopting a three-band model and time-dependent perturbation theory. These expressions include a single Airy function of well defined argument which can be detected around the critical point of interest. At energy just below the threshold M_0, the formula of the absorption coefficient tends to the exponential tail of the Franz-Keldysh type. Above the threshold it gives an oscillating structure around its zero field value and can be reduced to the usual formula of the zero field absorption as the electric field tends to zero. Such a formula at M_0 is much simpler than that given by Yang using a different approach. Yang's formula includes two Airy functions subtracted from each other. The arguments of these Airy functions are not easy to investigate in the energy range of interest. Further, the effect of anisotropy in the effective masses and a numerical application in the case of ZnS are included. (INIS)

7207 (JUL-1128-RW) CONTRIBUTION TO THE DEVELOPMENT OF REACTOR GRAPHITES AND PYROCARBONS: IRRADIATION BEHAVIOR, MODEL CONCEPTIONS, AND CHARACTERIZATION. Papers Presented at the 4th London International Carbon and Graphite Conference, London, England, 23–27 September 1974. Koizlik, K. (comp.). (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Reaktorwerkstoffe und Heisse Zellen). Oct 1974. 67p. (CONF-7409114-). Dep. NTIS (US Sales Only) $6.50.

The Institut fur Reaktorwerkstoffe der Kernforschungsanlage Julich has taken part in the 4th London International Carbon and Graphite Conference with four papers, one on graphite and three on pyrocarbon. These papers describe and discuss some of the latest results of the investigations on graphites and pyrocarbons done in the IRW. The first contribution deals with property changes of graphite materials by fast neutron irradiation and gives interpretations based on the irradiation induced graphitization. The next two papers discuss experimental work to set up new model conceptions for the deposition of pyrocarbon and for the pyrocarbon itself. The last presentation describes modern characterization methods for pyrocarbon. (auth)

7208 (PEL-238) WOOD-POLYMER COMPOSITE MOSAIC FLOORING IN SOUTH AFRICA. A Technical and Economic Evaluation. du Plessis, T. A.; Stevens, R. C. B. (Atomic Energy Board, Pelindaba, Pretoria (South Africa)). Jun 1974. 34p. Dep. NTIS (US Sales Only) $4.75.

The suitability of wood-polymer composites as a mosaic flooring material and, further, whether it could become an economically viable competitor with the hardwoods currently being used by the mosaic flooring industry were investigated. That wood-polymer composites are eminently suitable as a flooring material there can be no doubt, as its wearing capabilities and dimensional stability are virtually unsurpassable. Furthermore, the material has an appealing appearance. The economic aspect, however, is perhaps somewhat disheartening but should be reviewed from time to time. (auth)

7209 METHOD FOR HARDENING A COATING MATERIAL. Maruyama, T.; Araki, K.; Sasaki, T.; Shigematsu, T. (to Japan Atomic Energy Research Inst.). Japanese Patent 1973-24805/B/. 15 Jul 1970. 4p. (In Japanese).

The hardening of a coating, particularly of a polymerizable resin, is improved by a process in which the surface of the coating layer is sealed with a liquid metal, followed by hardening the coating either in the presence of a polymerization initiator or by the action of ionizing radiations. In accordance with this operation it is easy to produce a tough and smooth coating layer. The resin may be any polymerizable coating resin, particularly the products of the reaction between unsaturated acids and secondary or higher alcohols. The polymerization initiators may be peroxides or Redox initiators with or without peroxides. The liquid metals may be mercury, various kinds of amalgams and fusible alloys. In one of the examples, a decorative plate 3 mm in thickness coated with an unsaturated polyester resin 200 μ in thickness is floated on Wood's alloy at 77°C, then irradiated with electron beams at an energy level of 1.75 MeV, repeating the operation three times, with one Mrad of electron beam irradiation each time at an electron beam current of 2 mA. The coating layer thus hardened shows a pencil hardness of 5H, whereas the coating layers produced by the conventional processes yield hardnesses of 2B to HB. (JA)

7210 NOVEL COATING MATERIAL. Kimura, T.; Kobayashi, S.; Nakamoto, H. (to Mitsubishi Rayon Co. Ltd.). Japanese Patent 1973-22167/B/. 31 Jan 1969. 5p. (In Japanese).

An acrylic non-solvent type coating material rapidly hardenable in the presence of catalysts or by the action of light, ionizing radiation or the like; and a process for the material's manufacture is disclosed. The novel coating material comprises a vinyl monomer consisting of 30 to 100 wt.% of an acrylic monomer and 0 to 70 wt.% of copolymerizable vinyl monomers as well as a precursor formed by reacting at least 0.1 mol of a carboxylic acid anhydride containing an unsaturated polymerizable group with 1 mol of an epoxy group contained in a polymer of atomic weight $5 \times 10^3 - 1 \times 10^5$ consisting of 1 to 40 wt.% of a vinyl monomer containing an epoxy group, 30 to 99% by weight of an acrylic monomer, and 0 to 69 wt.% of other copolymerizable vinyl monomers. Since the polymerization of the coating material according to this invention is not liable to be inhibited by oxygen and the hardening can be completed with a small dose at a high dose rate, this coating material with a high G value is advantageous for industrial use. In the hardening process, radiation or light is utilized. Electron beams from an electron accelerator of 0.1 to 2.0 MeV are employed with a dose of 0.5 to 10 Mrad at a dose rate of 0.1 to 20 Mrad/sec. When light is used, light and ultraviolet light of wavelength between 2,000 and 8,000 Å is employed with a light sensitizer or radical generator. (JA)

7211 PROCESS FOR PRODUCING A THERMO-CONTRACTIVE FILM. Nakada, S.; Matsui, H. (to Sekisui Chemical Co. Ltd.). Japanese Patent 1973-20432/B/. 29 Jan 1970. 4p. (In Japanese).

Ethylene resin films having good thermal contractivity and heat resistance are produced by molding ethylene resin powder into a film while introducing crosslinks or grafts by kneading the powder at a temperature not less than the melting point, and elongating them at a temperature not less than the softening point. The ethylene resin powder is prepared in such a way that peroxide radicals are produced in the molecules by the action of ionizing radiation in the presence of oxygen in an amount so as not to introduce crosslinks between the molecules of the resin powder. Polyethylenes of varying densities and ethylene copolymers used as ethylene resin are powdered so as to pass through −20 mesh screen and irradiated with ionizing radiation at a dose rate of not more than 3 mrad/sec with a dose of 0.1 to 5 Mrad in the presence of oxygen or air. According to one of the examples, low density polyethylene pulverized to particle size through −20 mesh and irradiated with gamma-rays from ^{60}Co at 0.1 Mr/hr with a total dose of 1.5 Mr, is extruded through a 13 mmϕ annular slit die at 90°C, 150°C and 165°C. The produced tube is blown to 150 mmϕ and cooled to form a film of gelation ratio of 18%, contractivity 65% and contraction strength 2.5 g/mm^2. (JA)

7212 METHOD FOR FORMING A COATING LAYER. Suetsugu, M.; Kimura, T.; Kobayashi, S.; Matsushima, K.; Nakamoto, H. (to Mitsubishi Rayon Co. Ltd.). Japanese Patent 1973-20607/B/. 18 May 1970. 10p. (In Japanese).

A method of forming a coating layer on an object to be coated comprises the steps of treating the object with a compound having at least one isocyanate radical and at least one polymerizable vinyl radical, applying a polymerizable vinyl compound having 0.5 to 12 vinyl radicals per 1,000 molecules to the surface of treated object, and irradiating the applied coating material with high energy radiation to harden the coating. The coatings thus obtained lead to various improvements, including resistance to corrosion. In embodiments, the following compositions are prepared: (1) a composition consisting of an unsaturated polyester alone or in combination with vinyl monomers, which are derived from polycarboxylic acid and polyhydric alcohol, (2) a composition the principal polymer of which has polymerizable unsaturated radicals on its chain, (3) a composition consisting of vinyl monomers and a denatured polyester or polyamide, and (4) vinyl monomers such as meta-acrylate, stylene and the like. The compositions listed above as (1) to (4) are cross-linked by the action of a beam of electrons at an energy level of 0.1 to 2 MeV at a dose rate of 0.1 to 20 Mrad/sec, with a dose of 0.1 to 10 Mrad, or the action of ultraviolet or visible light (2,000 to 8,000A) in the presence of 0.1 to 5% by weight of catalysts such as benzoin, anthraquinone, azo-isobutyl nitrile, benzoil peroxide, and the like. (JA)

7213 EXOELECTRON EMISSION OF CADMIUM SULFIDE AFTER BOMBARDMENT BY LOW-ENERGY ELECTRONS. Mil'man, I. I.; Kryuk, V. I.; Drozdova, T. A.; Peysakh, Yu. I. Radio Eng. Electron. Phys. (USSR) (Engl. Transl.); 19: No. 3, 147-148(Mar 1974).

Translated from Radiotekh. Elektron.; 19: No. 3, 654-655(Mar 1974).

The results of a measurement of the exoemission activity of a CdS film after irradiation with electrons at energies up to 6 keV are presented. The study was undertaken in solving the problem of the radiation resistance of insulators and semiconductors. CdS is used in the form of thin-film coatings on an insulator substrate for making various electronic circuit elements. (WHK)

7214 INTERACTION OF ION BEAMS WITH POLYMER SURFACES LEADING TO ETCHING AND SPUTTERING PROCESSES. Weissmantel, C.; Rost, M.; Fiedler, O.; Erler, H. J.; Giegengack, H.; Horn, J. Jap. J. Appl. Phys.; No. Suppl. 2, 439-442(1974).

From 6th international vacuum congress; Kyoto, Japan (25 Mar 1974). See CONF-740353-.

The investigation of etching and sputtering processes at polymer surfaces, especially polytetrafluoroethylene (PTFE), caused by 1 to 10 keV ions led to interesting results. At the target surface a characteristic fiberlike microstructure of quasicrystallites is developed, and the sputter yields of this selective surface etching are unusually high ($\approx 10^3$ CF_2-groups per incident ion). Films deposited from these fragments with ion beam sputtering under high vacuum conditions are transparent, they possess a (100)-quasicrystalline orientation and a low friction coefficient. (auth)

7215 ENDOR STUDY OF THE DIVACANCY IN SILICON. de Wit, J. G. Amsterdam; Univ. Amsterdam (1975). 106p.

Thesis.

After an introduction into the combined field of magnetic resonance and lattice defects, the most important concepts of ESR and ENDOR and the experimental set-up are described. The results are analyzed using a wavefunction which is constructed as a linear combination of atomic orbitals. Molecular orbital calculations using the extended Hückel theory have been performed on clusters of silicon atoms with a divacancy at the center. (NL)

7216 URANIUM (IV) SODIUM MOLYBDATES AND TUNGSTATES. Lee, M. R.; Mahe, P. (Paris-6 Univ., 75 (France)). C. R., Ser. C.; 279: No. 26, 1137-1140(23 Dec 1974). (In French).

The solid-liquid equilibrium diagrams of the UMo_2O_8-Na_2MoO_4 and UW_2O_8-Na_2WO_4 systems were established, and four new phases were identified using X-ray diffraction in powder and single crystals: $Na_2U(MoO_4)$ and $Na_2U(WO_4)_2$ with a scheelite structure; $Na_4U(MoO_4)_4$ and $Na_4U(WO_4)_4$ monoclinic. (FR)

7217 GRINDING AND CLASSIFICATION OF CRYSTALLINE BORON POWDERS. Tsomaya, K. P.; Tavadze, F. N.; Uvarov, V. V.; Gabuniya, D. L.; Knyshev, E. A.; Kobyakov, V. A. (Inst. of Problems in Materials Science, Kiev). Porosh. Met., Akad. Nauk Ukr. SSR; No. 2, 87-91(Feb 1975). (In Russian).

The developed method of grinding and classification of crystalline boron powders is described. The data of radiographic examinations of the ground powders are presented. A conclusion is made that in the process of crystalline boron fine dispersion there occurs amorphization of its particles. (auth)

7218 ELECTRON-MICROSCOPIC AND ELECTRONOGRAPHIC STUDIES OF DISPERSED BORON POWDERS. Tsomaya, K. P. (Inst. of Metallurgy, Tbilisi, USSR). Porosh. Met., Akad. Nauk Ukr. SSR; No. 3, 87-92(Mar 1975). (In Russian).

The results are presented of electron-microscopic and electrographic studies of ground powders of crystalline boron. A model is suggested for the phenomenon of crystalline boron amorphization occurring in the process of mechanical dispersion. (auth)

7219 FORMATION OF SUBSTITUTIONAL HYDROGEN CENTERS IN LiF:OH CRYSTALS. Kamikawa, T. (Yamagata Univ.). Phys. Status Solidi B.; 68: No. 2, 639-643(1 Apr 1975).

ESR and infrared absorption are measured on neutron-irradiated LiF:OH crystals. In unirradiated specimens a sharp absorption at 2.8 μm is observed and attributed to OH^- ions coupled to a Mg impurity. After neutron irradiation the 2.8 μm band disappears and a broad band appears at 1930 cm^{-1}. When the irradiated crystal is annealed at higher temperatures, the 1930 cm^{-1} band increases a little and then decreases. In parallel with the decay of the 1930 cm^{-1} band, another absorption band grows peaking at 1013 cm^{-1}, which is attributed to U centers in LiF. H^0 centers are observed by ESR in neutron-irradiated crystals. On annealing at higher temperatures the H^0 centers increase as the 1013 cm^{-1} band grows. While the 1013 cm^{-1} band increases monotonously with temperature, the H^0 centers decrease above 270°C. It is concluded that hydrogen centers are produced by dissociation of OH^- ions in neutron-irradiated LiF:OH crystals and that immediately after irradiation U centers do not exist, which are formed in the course of annealing from the precursor suggested to be U_1 centers and afterwards from H^0 centers. (auth)

7220 ELECTRICAL TESTS OF SHORT MODELS OF POLYETHYLENE TAPE DIELECTRIC FOR A SUPERCONDUCTING AC CABLE. Williams, B. G. (Central Electricity Research Labs., Leatherhead, Eng.). Cryogenics; 15: No. 3, 135-136 (Mar 1975).

Electrical tests on short models of the dielectric for a lapped polyethylene insulated superconducting cable are described. Impulse breakdown strengths and 50 Hz discharge inception fields are reported. The impulse strengths were encouraging but the discharge inception fields showed that further development is required. (auth)

7221 REACHING A TEMPERATURE OF 0.64°K IN A ^{4}He CRYOSTAT WITH A NEW GEOMETRY. Goldschvartz, J. M.; van der Merwe, W. P.; Kollen, A. (Delft Univ. of Technology, Netherlands). Cryogenics; 15: No. 3, 153-154(Mar 1975).

The first reproducible results obtained with a new design of cryostat which includes an Helium 11 film trap and a charcoal adsorption pump, are reported. A cross-section with the features of the cryostat is shown. Instead of having the adsorption pump inside the vessel and above the surface of the liquid helium, whose temperature is being reduced, as cryostats with an adsorption pump are normally made, here the charcoal surrounds the liquid helium vessel. This charcoal is cooled by the liquid helium in a dewar. In this way it is possible to obtain a greater pumping speed and adsorption capacity since the adsorption pump can contain a large amount of charcoal. (UK)

7222 DIRECT COMPARISON OF MOESSBAUER AND CHANNELING STUDIES OF IMPLANTED ^{119}Sn IN SILICON SINGLE CRYSTALS. Weyer, G.; Andersen, J. U.; Deutch, B. I.; Golovchenko, J. A.; Nylandsted-Larsen, A. (Univ. of Aarhus, Denmark). Radiat. Eff.; 24: No. 2, 117-121(1975).

Mössbauer parameters, measured using a resonance counter, have been compared with channeling results on the same samples, for ^{119m}Sn implanted into silicon single crystals. The implantation dose was varied between $\sim 10^{14}$ and $\sim 10^{17}$ atoms/cm^2, for target temperatures of 20 and 400°C. The channeling results in hot implants show that Sn is embedded substitutionally, and the Mössbauer parameters are nearly dose independent in the range indicated above. Except for a very low-dose implant ($\sim 10^{13}$ atoms/cm^2) the room-temperature implants lead to complete damage (no channeling dip) and significantly different Mössbauer parameters. Subsequent annealing at 700°C, however, leads to values close to those characteristic of hot implants. The small dose dependence for hot implants, even for doses leading to ~80% damage, as measured by channeling, indicates that the microscopic ordering is preserved. (auth)

7223 IN BEAM MEASUREMENTS OF THE F COLOURING CURVES FOR NaCl AT AND ABOVE ROOM TEMPERATURE. Hodgson, E. R.; Delgado, A.; Rivas, J. L. A. (Junta de Energia Nuclear, Madrid). Solid State Commun.; 16: No. 6, 785-788 (15 Mar 1975).

In beam measurements have been made of the F coloring curves in NaCl between 20 and 300°C. The first coloring stage has been empirically fitted by up to three exponential components which become smaller and faster with increasing temperature. A model is presented which gives physical significance to the fitting parameters. (auth)

NUCLEAR MATERIALS AND WASTE MANAGEMENT

Accountability and Safeguards

7224 (ALO-3) INSPECTOR MEASUREMENT VERIFICATION ACTIVITIES. George, R. S.; Crouch, R. B. (Energy Research and Development Administration, Albuquerque, N. Mex. (USA). Albuquerque Operations Office). [nd]. 10p. (CONF-750608-1). Dep. NTIS $4.00.

From annual meeting of the institute of nuclear materials management; New Orleans, Louisiana, USA (18 Jun 1975).

The most difficult and complex activity facing a safeguards inspector involves the verification of measurements and the performance of the measurement system. Remeasurement is the key to measurement verification activities. Remeasurements using the facility's measurement system provide the bulk of the data needed for determining the performance of the measurement system. Remeasurements by reference laboratories are also important for evaluation of the measurement system and determination of systematic errors. The use of these measurement verification activities in conjunction with accepted inventory verification practices provides a better basis for accepting or rejecting an inventory. (auth)

7225 (ARH-SA-220) REAL-TIME PLUTONIUM ACCOUNTABILITY AND INVENTORY CONTROL SYSTEM. Sarich, J. P. (Atlantic Richfield Hanford Co., Richfield Hanford Co., Richland, Wash. (USA)). [nd]. 6p. (CONF-750608-2). Dep. NTIS $4.00.

From annual meeting of the institute of nuclear materials management; New Orleans, Louisiana, USA (18 Jun 1975).

An on-line inventory system for a large storage and processing facility is planned. A terminal system will provide for interactive updating and information retrieval. The data base will contain information on inventory items and transactions, as well as process monitoring information and laboratory bookkeeping data. Access to the terminals, as well as the storage vaults, will be controlled by fingerprint comparison with a personnel identification data base. Bar code labels attached to each inventory item will be read by a light pen during physical inventories and when materials are transferred. The use of devices to continuously monitor and control storage locations within the vaults is planned. (auth)

7226 (BNWL-B-179) TABLE OF SAMPLE SIZES NEEDED TO DETECT AT LEAST ONE DEFECTIVE WITH 100(1-alpha) PERCENT PROBABILITY (alpha equals 0.01, 0.05). Stewart, K. B. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 26 May 1972. Contract AT(45-1)-1830. 62p. Dep. NTIS $6.25.

Tables are presented which give the random sample size needed in order to be 95 percent(99 percent) certain of detecting at least one defective item when there are k defective items in a population of n items. The application of the tables to certain safeguards problems is discussed. The range of the tables is as follows: r equals 0(1)25, n equals r(1)r + 999. (auth)

7227 (CONF-750514-2) APPLICATION OF CRIME COUNTERMEASURES FOR THE PROTECTION OF NUCLEAR MATERIALS. Bean, C. H. (Argonne National Lab., Ill. (USA)). 1975. Contract W-31-109-Eng-38. 9p. Dep. NTIS $4.00.

From Carnahan conference on crime countermeasures; Lexington, Kentucky, USA (7 May 1975).

Federal regulations prepared by the Nuclear Regulatory Commission and published in the Federal Register require licensees to take appropriate action to protect the health and safety of the public from unauthorized use of special nuclear material (SNM), which includes plutonium, uranium-233, and highly enriched uranium. Crime countermeasures for compliance with these regulations are an important part of the guidance that is provided by the NRC's Office of Standards Development. The use of crime countermeasures and protective devices is intended to prevent the unauthorized diversion of material and to aid in the detection of diversion should it be attempted. Plant and equipment designs should incorporate both electronic and physical security measures for protection of SNM. This applies to facilities and equipment for reprocessing, fabrication, and transportation of SNM. The protection systems include physical barriers, access controls, intrusion detection devices, surveillance devices, central alarm stations, communications, and response capability. Acceptable security measures and devices applicable to protected areas, material access areas, vital areas, vital equipment, and transportation vehicles have been presented in Regulatory Guides. (auth)

7228 (EUR-5108e) ULTRASONIC SIGNATURE. Borloo, E.; Crutzen, S. (Commission of the European Communities, Ispra (Italy). Joint Research Centre). 1974. 54p. Dep. NTIS (US Sales Only) $5.75. EUR B. Fr. 60,-.

A tamperproof identification technique for safeguarding fissile materials based on ultrasonic readouts is described. (TFD)

7229 (LA-5889-PR) NUCLEAR ANALYSIS RESEARCH AND DEVELOPMENT. Program Status Report, September–December 1974. (Los Alamos Scientific Lab., N. Mex. (USA)). Apr 1975. Contract W-7405-eng-36. 28p. Dep. NTIS $4.00.

This report presents the status of the Nondestructive Assay R&D program of the LASL Nuclear Analysis Research Group, A-1. The following topics are discussed. ^{252}Cf fuel-rod assay system for green HTGR fuel rods; assay of HTGR fuel rods using thermal-neutron interrogation; automated random driver mod-III for NDA of HTGR in-process fuel; delayed-neutron assay of low-level uranium samples using the Van de Graaff; status of the NRDS active assay system; segmented gamma scanner adaptations for in-plant ^{235}U assay; gamma-ray and passive-neutron assay of waste drums; comparison of segmented gamma scanner for plutonium assay at ARHCO and LASL; application of gamma-ray counting to low-level transuranic waste; study of holdup in mixed-oxide plutonium facilities; differential absorption attenuation correction factor; gamma-ray box counter for low-level waste assay; modulated ^{252}Cf assay system "Shuffler"; ^{252}Cf-based hydrogen monitor; ^{4}He gas scintillator for prompt-neutron fissile assay of small samples; automated neutron assay equipment for Richland Operations Office; minicomputer software modifications for the ERDA New Brunswick Laboratory; and USERDA nondestructive assay training program. (TFD)

7230 (NBSIR-74-524) PRACTICALITY OF DIVERSION PATH ANALYSIS. Murphey, W. M.; Schleter, J. C. (National Bureau of Standards, Washington, D. C. (USA)). Jul 1974. 35p. Dep. NTIS $4.75.

One can define the safeguards system for nuclear material as the set of all protective actions taken to prevent or to deter attempts to divert nuclear material to unauthorized use. Maintenance of effective safeguards requires a program for routine assessment of plant safeguards systems in terms of their capabilities to satisfy safeguards aims. Plant internal control systems provide capabilities for detection of unprevented diversion and can provide assurance that diversion has not occurred. A procedure called Diversion Path Analysis (DPA) enables routine assessment of the capabilities of internal control systems in this regard and identification of safeguards problem areas in a plant. A framework for safeguards system design is also provided which will allow flexibility to accommodate individual plant circumstances while maintaining acceptable diversion detection capability. The steps of the procedure are described and the practicality of the analytical method is shown by referring to a demonstration test for a high throughput process where plant personnel were major participants. The boundary conditions for the demonstration case are given, along with some conclusions about the general procedure. (auth)

7231 (NBSIR-74-592) SAFEGUARDS INFORMATION SYSTEM FLOWS ASSOCIATED WITH THE PLANT SAFEGUARDS AUTHORITY. Schleter, J. C. (National Bureau of Standards, Washington, D. C. (USA)). Nov 1974. 58p. Dep. NTIS $6.00.

Increasing use of nuclear material imposes additional emphasis on safeguards. The Technical Analysis Division, NBS, has been assisting the AEC in performing systems studies directed to safeguards for nuclear materials. A Safeguards Information System (SIS) is being developed so as to provide the information and decision structure needed for assurance that significant diversion to unauthorized use has not occurred in the past and, further, that any significant diversion which might occur in the future will be detected in a timely manner. Although a comprehensive report is in preparation, a preview is considered useful at this time in order to familiarize plant personnel, charged with development of plant safeguards information systems, with aspects of SIS. This report thus reflects material from the forthcoming report and directs attention to the information flows related to the key safeguards decision maker within the plant - the plant safeguards authority. Terms and concepts are defined and their application is illustrated in the general case by highlighting decision responsibilities and details of the safeguards information flows associated with him. (auth)

7232 (NUREG-75/010) METHODS FOR THE ACCOUNTABILITY OF URANIUM DIOXIDE. Stephens, F. B.; Gutmacher, R. G.; Ernst, K.; Harrar, J. E.; Turel, S. P. (California Univ., Livermore (USA). Lawrence Livermore Lab.; Nuclear Regula-

tory Commission, Washington, D. C. (USA)). Jun 1975. 178p. Dep. NTIS $7.00.

Procedures for the determination of the total U and the amount of ^{235}U isotope in UO_2 powder and pellets are given. Methods for U determination include coulometry, titration, and gravimetry. Surface-ionization mass spectroscopy is described for ^{235}U measurement. Spectrometric procedures are described for determining the impurity content in the UO_2. (TFD)

7233 (REG/G-5.52(5-75)) STANDARD FORMAT AND CONTENT FOR THE PHYSICAL PROTECTION SECTION OF A LICENSE APPLICATION (FOR FACILITIES OTHER THAN NUCLEAR POWER PLANTS). (Nuclear Regulatory Commission, Washington, D. C. (USA). Office of Standards Development). May 1975. 68p. NRC.

This standard format document has been prepared as an aid to uniformity and completeness in the preparation and review of the physical protection section of license applications. It is applicable to fuel reprocessing plants, fuel manufacturing plants, SNM transportation, or other special nuclear material operations involving the possession and use of uranium 235 (contained in uranium enriched to 20 percent or more in the U-235 isotope), uranium 233, or plutonium alone or in any combination in a quantity of 5000 g or more computed by the formula: g equals (g contained U-235) + 2.5 (g U-233 + g plutonium). This document is not intended to be used for nuclear power plants. (auth)

Disposal and Storage

Refer also to abstracts 6080, 6082, 6083, 6089, 6430, 6595, 6698, 6794, 7244, 8387, and 8391.

7234 (BNWL-SA-5311) SHIELDING ANALYSIS OF THE RETRIEVABLE SURFACE STORAGE FACILITY. Zimmerman, M. G. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1974. Contract RL-04-16A. 6p. (CONF-750607-1). Dep. NTIS $4.00.

From American Nuclear Society meeting; New Orleans, Louisiana, USA (8 Jun 1975).

A shielding analysis of the proposed Retrievable Surface Storage Facility was made by calculating the dose rates from neutrons and primary and secondary gammas at the outer surface of the cylindrical waste storage module based on source strengths calculated by the code ORIGEN. Calculations were performed for several combinations of shields including steel, concrete, and water, with the main emphasis on concrete. The loadings considered included equilibrium cycle waste from PWR, LMFBR, and HTGR type reactors. Dose rates calculated for PWR uranium cycle waste are presented. (LCL)

7235 (KFK-2089) EXPERIENCES IN THE MANAGEMENT OF PLUTONIUM-CONTAINING SOLID-WASTES AT THE NUCLEAR RESEARCH CENTER KARLSRUHE. Baehr, W.; Hild, W.; Scheffler, K. (Gesellschaft fuer Kernforschung m.b.H., Karlsruhe (F. R. Germany)). Oct 1974. 16p. (CONF-741026-10). Dep. NTIS (US Sales Only) $4.00.

From seminar on the management of plutonium-contaminated solid wastes; Marcoule, France (14 Oct 1974).

Solid plutonium-containing wastes from a fuel production plant, a reprocessing plant and several research laboratories are treated at the decontamination department of the Karlsruhe Nuclear Research Center for disposal in the Asse salt mine. Conditioning as well as future aspects in α-waste management are discussed. (auth)

7236 (LIB/Trans-548) DEVELOPMENTS IN THE MANAGEMENT OF LOW AND INTERMEDIATE ACTIVITY SOLID WASTES AT THE CADARACHE CENTRE. Barbreau, A.; Marcaillou, J.; Mery, J.; Pinto, D.; Rancon, D. Jan 1975. Translation by W. Buykx of SM-137/16. (CONF-700905-15). 49p. Dep. NTIS (US Sales Only) $5.50.

From symposium on developments in the management of low and intermediate level radioactive wastes; Aix-en-Provence, France (7 Sep 1970).

Methods used at the Cadarache Center for processing and storing low and intermediate activity solid wastes, including Pu-contaminated wastes, contaminated sodium, irradiated structural materials from reactors, and solid wastes from machining and cleaning operations involved in spent fuel element inspections in hot cells, are described. The cost of the waste management operations are estimated. The disposal site geology and hydrology are described. It is concluded that the radiological hazards from solid waste disposal at this site are almost non-existent, and that 100,000 m^3 of solid wastes could be stored. (LCL)

7237 (RISO-M-1786) RADIOACTIVE WASTE FROM NUCLEAR POWER PLANTS FROM THE STAGES OF THE NUCLEAR FUEL CYCLE. Brodersen, K. (Danish Atomic Energy Commission, Risoe. Research Establishment). Mar 1975. 72p. Dep. NTIS (US Sales Only) $6.75.

Methods used in the management of radioactive wastes from nuclear power plants and from the various stages of the nuclear fuel cycle are summarized. Comments are made on most of the issues raised in the public debate on radioactive waste. The problems are to some extent quantified and compared with other industrial waste problems. (auth)

7238 (SAND-74-7017) NUCLEAR WASTES IN THE DEEP SEABED. Bishop, W. P.; Anderson, D. R.; Hollister, C. D. (Sandia Labs., Albuquerque, N. Mex. (USA); Woods Hole Oceanographic Institution, Mass. (USA)). 1974. 8p. (CONF-750522-1). Dep. NTIS $4.00.

From 2nd biennial topical meeting on the ocean, nuclear energy and man; Tarpon Springs, Florida, USA (7 May 1975).

The feasibility of using the mid-plate/mid-gyre regions of oceans as seabed disposal sites for transuranic-containing high-level wastes from the nuclear power industry is discussed. (LCL)

7239 (SAND-75-5294) HIGH LEVEL WASTE MELTING EXPERIMENT. Klett, R. D. (Sandia Labs., Albuquerque, N. Mex. (USA)). 1975. 16p. (CONF-750321-1). Dep. NTIS $4.00.

From conference on waste management 75; Tucson, Arizona, USA (24 Mar 1975).

An overview is given of the Deep Rock High Level Nuclear Waste Disposal Process (DRD) and the first medium scale demonstration test (DRD-1). The DRD process consists of placing solidified high-level waste (or mixtures of high and low-level waste), either uncontained or in expendable containers, in holes several kilometers deep which are drilled into bedrock. With the holes 0.3 to 3 m in dia, the radioactive decay heat would melt and mix the waste and surrounding rock. After resolidification in 5 to 20 years, the waste/rock matrix would form a dilute, low surface area, low leachability solid plug permanently emplaced several kilometers below the earth's surface. Progress to date in identifying and developing DRD technology has centered around the DRD-1 test. In this experiment, a waste simulant was electrically heated to 1320°C in a 1 m by 0.15 m dia cavity in a block of dolerite rock. The presence of convection and mixing was confirmed and the thermal model of the test was verified. The leachability of the resolidified rock/simulant matrix was low, and the experiment hardware survived the test environment. A scale-up of this test should be possible. Although the DRD concept has not been proven feasible, progress to date indicates that further study is warranted. (auth)

7240 WATER LEVEL FLUCTUATIONS DUE TO EARTH TIDES IN A WELL PUMPING FROM SLIGHTLY FRACTURED CRYSTALLINE ROCK. Marine, I. W. (Du Pont de Nemours and Co., Aiken, SC). Water Resour. Res.; 11: No. 1, 165-173 (Feb 1975).

At the Savannah River plant of the Atomic Energy Commission near Aiken, South Carolina, there are three distinct groundwater systems: the coastal plain sediments, the crystalline metamorphic rocks, and a buried Triassic basin. The coastal plain sediments include several Cretaceous and Tertiary granular aquifers and aquicludes, the total thickness being about 305 m. Below these sediments, water occurs in small fractures in crystalline metamorphic rock (hornblende schist and gneiss with lesser amounts of quartzite). Water level fluctuations due to earth tides are recorded in the crystalline metamorphic rock system and in the coastal plain sediments. No water level fluctuations due to earth tides have been observed in wells in the Triassic rock because of the very low permeability. The water level fluctuations due to earth tides in the crystalline rock are about 10 cm, and those in the sediments are about 1.8 cm. The use of water level fluctuations due to earth tides to calculate porosity appears to present practical difficulties both in the crystalline metamorphic rock system and in the coastal plain sediments. In a 1-yr pumping test on a well in the crystalline metamorphic rock the flow was controlled to within 0.1 percent of the total discharge, which was 0.94 l/s. The water level fluctuations due to earth tides in the pumping well were 10 cm, the same as when this well was not being pumped. (auth)

7241 FISSILE-SOLUTION STORAGE IN PIPES ISOLATED BY CONCRETE OR WATER. Altschuler, S. J.; Schuske, C. L. (Dow Chemical, Golden, CO). Nucl. Technol.; 26: No. 1, 23-34 (May 1975).

The storage of fissile solutions in tall cylinders neutronically isolated from each other by a moderating material, such as water or concrete, permits critically safe arrays that can be much more compact than arrays in air. Calculations show that up to ten times as many cylinders can be placed on a given floor area in such isolated arrays than in air-spaced arrays. However, this advantage must be weighed against the cost of construction and main-

tenance of moderated arrays. The water or concrete used as the isolating moderator also provides some personnel shielding against penetrating radiation. (auth)

7242 STORAGE OF RADIOACTIVE WASTE. Pittman, F. K. (Atomic Energy Commission, Washington, DC). Aware; No. 48, 2-4(Sep 1974).

Four methods for managing radioactive waste in order to protect man from its potential hazards include: transmutation to convert radioisotopes in waste to stable isotopes; disposal in space; geological disposal; and surface storage in shielded, cooled, and monitored containers. A comparison of these methods shows geologic disposal in stable formations beneath landmasses appears to be the most feasible with today's technology. (LCL)

Handling Equipment and Procedures

Refer also to abstract 6794.

7243 (ARH-LD-109) REANALYSIS OF IDEALIZED PLUTONIUM DISSOLVERS AND THE "ALWAYS SAFE" CONDITIONS. Brown, C. O.; Carter, R. D. (Atlantic Richfield Hanford Co., Richland, Wash. (USA)). Feb 1975. Contract AT(45-1)-2130. 14p. Dep. NTIS $4.00.

In criticality safety analysis, it often becomes convenient to have available for reference critical mass information for generalized systems. In 1963, a report was published by Messrs. W. A. Reardon and C. F. Czerniejewski which dealt with minimum critical mass calculations for a fully water-reflected idealized (spherical) plutonium dissolver system (HW-SA-2999). The report provides data on minimum critical masses, critical volumes, etc., for an idealized three-region system representing plutonium-239 metal dissolving into solution. With the improved computer code calculation techniques now available, a study was undertaken to update the original results. The calculations were performed under the same general conditions as in the original document, the primary difference being the use of the DTF-IV transport theory code with GAMTEC II code cross sections in lieu of the S-X^2 transport theory code and LAMS-2453 cross sections. In addition, the diffusion theory code HFN replaced the 9-Zoom diffusion theory code used for the homogeneous system in the original calculations. Plutonium-water solutions were used instead of plutonium oxide-water solution in the earlier work. This last change, however, has no significant effect on the calculations for the plutonium solution concentrations used. Because of significant differences, both the original data and the updated results are included. (auth)

Transportation

7244 (BNWL-1903) IMPACT TESTING OF VITREOUS SIMULATED HIGH-LEVEL WASTE IN CANISTERS. Smith, T. H.; Ross, W. A. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). May 1975. Contract AT(45-1)-1830. 115p. Dep. NTIS $5.45.

This work was performed in support of a risk analysis of a conceptual management system for high-level nuclear waste. Mechanical forces acting on a canister of solidified (e.g., vitrified) waste could not only fail the canister, but also break the glass into smaller, potentially respirable particles. The increased glass surface area would also hasten dissolution and volatilization if driving forces for these were present. The objectives, in order of priority, were to estimate (1) the quantity of respirable glass fines produced; (2) the increase in glass surface area; and (3) the impact resistance of the filled canisters. Even if all test canisters were to remain intact, the first two items are needed because it cannot be guaranteed that every production canister will be fabricated soundly and maintained properly. Two series of tests were conducted using nonradioactive waste glass type 72-68 (simulated waste composition PW-4b-2) in cylindrical 304L stainless steel canisters. Six specimens of a 1/2 scale model of a 10-ft canister were impacted at room temperature and at velocities up to 10 CFR 71 requirements of 44 fps. Twenty-two smaller specimens were tested at room temperature and at elevated temperature (425°C), at velocities up to that of high-speed train impact (80 mph or 117 fps). Both series included specimens which were essentially glassy and those which had been partially devitrified by thermal treatment. The canisters breached only at the two highest velocities (66 and 117 fps). The breaches were all very small cracks. Pre- and post-test weight checks indicated that very little, if any, glass escaped through the cracks. (auth)

7245 (COM-74-50492-R) EXPORT ADMINISTRATION REGULATIONS. (Bureau of East-West Trade, Washington, D. C. (USA). Office of Export Administration). 1 Jun 1974. 541p. GPO.

National security controls are instituted to provide control of exports from the standpoint of their significance to the security of the United States. Other controls are instituted from time to time to foster U. S. foreign policy and international responsibilities where no U. S. security considerations are involved. Short supply controls are used only when they are necessary to protect the domestic economy. (GRA)

7246 (DPSPU-74-124-4) SAFETY ANALYSIS REPORT: PACKAGES, LP-12 Tritium Package (Packaging of Fissile and Other Radioactive Materials). Final Report. Gates, A. A.; McCarthy, P. G.; Edl, J. W. (Comps.). (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Plant). May 1975. Contract AT(07-2)-1. 100p. Dep. NTIS $8.00.

Elemental tritium is shipped at low pressure in a stainless steel container (LP-12) within an aluminum vessel and surrounded by 3.9 in.-thick Celotex insulation in a steel drum. Information is presented on the packaging design, evaluation of the structural, thermal, containment, shielding, and criticality characteristics of the package, procedures for loading, unloading, and transporting, and testing the LP-12, and quality assurance requirements. (LCL)

7247 (DPSPU-74-124-5) SAFETY ANALYSIS REPORT: PACKAGES, LP-50 Tritium Package (Packaging of Fissile and Other Radioactive Materials). Final Report. Gates, A. A.; McCarthy, P. G.; Edl, J. W. (comps.). (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Plant). Apr 1975. Contract AT(07-2)-1. 85p. Dep. NTIS $7.25.

Elemental tritium is shipped at low pressure in a stainless steel container (LP-50) sealed within an aluminum vessel and surrounded by a minimum of 4-in. thick Celotex insulation in a steel drum. The structural, thermal, containment, shielding, and criticality safety aspects of this package are evaluated. Procedures for loading and unloading, empty cask transport, acceptance testing and maintenance, and quality assurance requirements for the LP-50 package are described in detail. (LCL)

7248 (ERDA-8) TRANSPORTATION OF HIGH-LEVEL NUCLEAR WASTES. (Energy Research and Development Administration, Washington, D. C. (USA). Div. of Waste Management and Transportation). Nov 1974. 4p. Dep. NTIS $4.00.

Recommendations are made by the Committee on Radioactive Waste Management of the National Research Council--National Academy of Sciences--National Academy of Engineering to Dr. R. C. Seamans, administrator of ERDA, on developing information on the characteristics of high-level solid radioactive wastes, on research programs to further develop transportable wastes and to determine the effects of such transport on the environment and the public, and on ensuring that transport containers are of the safest design and quality. (LCL)

7249 (SAAS-171, pp 14-28) TRANSPORT OF FRESH AND SPENT NUCLEAR FUELS FROM THE POINT OF VIEW OF LICENSING AUTHORITIES. Richter, D.; Birkigt, W. Nov 1974. (In German).

In reports of the State Ministries for atomic safety and radiation protection of the DDR.

International and national safety regulations concerning the transport of nuclear fuels are reviewed. The individual stages of the licensing procedure are described and some experience in the nuclear fuel supply of the Rheinsberg nuclear power plant is dealt with. (auth)

7250 (Y-DD-41) Y-12 DRUM-TYPE SHIPPING CONTAINER SPECIFICATIONS. Handley, G. R.; Crume, E. C. Jr. (Oak Ridge Y-12 Plant, Tenn. (USA)). 6 Aug 1969. Contract W-7405-eng-26. 19p. Dep. NTIS $4.00.

Celotex-insulated, drum-type shipping containers will provide for safe shipment of many items which may not be shipped in any previously existing container. Its simplicity of design permits fast, low-cost production without the loss of required safety. Detailed calculational methods of criticality safety analysis which meet all requirements of AEC Manual Chapter 0529 have been determined for the container. (auth)

7251 SAFE TRANSPORT OF RADIOACTIVE MATERIALS. Swindell, G. E. Int. At. Energy Agency Bull.; 17: No. 1, 5-11 (Feb 1975).

In the course of transport by road, rail, sea and air, consignments of radioactive material are in close proximity to ordinary members of the public and in most cases they are loaded and unloaded by transport workers who have no special training or experience in the handling of radioactive substances. The materials being transported cover a wide variety—ranging from small batches of short-lived radionuclides used in medical practice which can be transported in small sealed lead pots in cardboard boxes to large, extremely radioactive consignments of

irradiated nuclear fuel in flasks weighing many tons. With the growing development of nuclear power programs the transport of irradiated fuel is likely to increase markedly. It is clear that unless adequate regulations concerning the design and assembly of the packages containing these materials are precisely set down and strictly carried out, there will be a high probability that some of the radioactive contents will be released, leading to contamination of other transported goods and the general environment, and to the delivery of a radiation dose to the transport workers and the public. An additional requirement is that the transport should proceed smoothly and without delay. This is particularly important for radioactive materials of short half-life, which would lose significant amounts of their total activity in unnecessary delays at international boundaries. Therefore, it is essential that the regulations are also enforced, to ensure that the radioactive material is contained and the surrounding radiation level reduced to a value which poses no threat to other sensitive goods such as photographic film, or to transport workers and other passengers. These regulations should be as uniform as possible on an international basis, so that consignments can move freely from one country to another with as little delay as possible at the frontiers. (auth)

PARTICLE ACCELERATORS

Design, Development, and Operation

7252 (NIRS-R-2, pp 100-105) AN INVESTIGATION ON THE RADIOACTIVE ATMOSPHERE CONTAMINATION PRODUCED IN THE MAINTENANCE WORKS OF A BIG CYCLOTRON. SuSuzuki, M.; Watanabe, S.; Hongo, S.; Ohno, S.; Ohata, T. Nov 1973. (In Japanese).

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7253 (NP-20397) DARESBURY 1974. (Science Research Council, Daresbury (UK). Daresbury Lab.). 1975. 52p. Dep. NTIS (US Sales Only) $5.75.

The report includes the following topics: high energy physics (NINA operations and research programme; CERN programme–technical support and experimental and theoretical studies); synchrotron radiation (synchrotron radiation facility, theory, synchrotron radiation source); nuclear structure (Nuclear Structure Facility Tandem, building the NSF, research and development programmes); computer systems. Appendices give information on finance and administration; health and safety; publications. (UK)

7254 (RL-75-043) LECTURE GIVEN AT THE RUTHERFORD LAB. March 10, 1975. Lawson, J. D. (Science Research Council, Chilton (UK). Rutherford Lab.). Mar 1975. 21p. Dep. NTIS (US Sales Only) $4.25.

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7255 LINEAR ACCELERATOR. Urabe, K.; Terashi, K.; Nagai, T. (to Tokyo Shibaura Electric Co. Ltd.). Japanese Patent 1973-24600/B/. 7 Nov 1969. 5p. (In Japanese).

It is required that the electron energy in a linear accelerator be varied over a wide range when it is used in radiography or other searches. A linear electron accelerator system is provided, in which the exciting power may be easily regulated with a simple circuitry. In the linear accelerator the electron flows in the accelerating tube from the electron gun, to which the high frequency oscillator feeds the accelerated wave; the branch circuit branches off the high frequency power of the oscillator; the phase-shifting circuit shifts the high frequency power thus branched off; the same high frequency power is added to the two branches; the hybrid circuit feeds the high frequency power to the accelerating tube according to the shifting angle of the phase-shift circuit. Thus, the linear accelerator allows the phase-shifting circuit to control the power feeding to the accelerating tube and adjust the electron power energy. (JA)

7256 QUASI-CONTINUOUSLY OPERATING INDUCTION ACCELERATORS. Kanunnikov, V. N.; Kolomenskii, A. A.; Mikhalev, P. S.; Fateev, A. P. At. Energ. (USSR); 38: No. 4, 234-239(Apr 1975). (In Russian).

Features and advantages of an FFAG electron accelerator with a non-resonant (induction) accelerating system are considered. Such an accelerator, e.g., fixed field betatron (FFB)—successfully combines the high time-averaged intensity of a linear accelerator and the good beam quality of cyclic accelerators. Construction and operating costs of an FFB are significantly less than those of a linear accelerator; FFB is suitable both for low and relatively high energies (up to ~100 to 200 MeV) used in photonuclear and electronuclear research. The experimental and theoretical results presented may serve as a basis for practical development and construction of an FFB. Parameters are listed for several high current betatrons with energies of 5 to 10 and 100 MeV having beam intensities of $\sim 10^{14}$ electrons/s (duty cycle factor ~10 to 15%). (auth)

7257 SIGNIFICANCE OF THE CYCLOTRON FOR RADIATION THERAPY AND DIAGNOSTICS. Bozoky, L. Fiz. Szemle; 24: No. 3, 65-69(Mar 1974). (In Hungarian).

Medical science was the first to make use of the newly discovered radiation sources at the end of the last century; x-rays, radium and later radioisotopes have been used for therapeutic and diagnostic purposes. The problem of medical use of neutron radiation has been taken up again, 20 years after the first unsuccessful attempts. While monoenergetic 14-MeV neutrons from D–T reactions were found unsuited for therapy, high-energy neutrons from D–Be reactions yielded a more favorable depth dose curve than irradiation with ^{60}Co. The radiation source for medical applications is the cyclotron, able to generate at least 35-MeV neutrons. Cyclotrons may be also used for the efficient preparation of short-half-life radioisotopes which allow to reduce considerably the radiation dose burden. There is great interest in Hungary in this technique; in addition to its six modern cobalt guns, the National Oncological Institute possesses also a 25-MeV betatron. It is proposed to procure a specialized medical cyclotron. (TTT)

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A decision has been made that the UKAEA at Harwell is to have a new 136 MeV electron linear accelerator intended mainly to provide data and develop theories needed in the design of fusion and fast fission reactors. (UK)

7259 HIGH-CURRENT ACCELERATOR OF ELECTRONS IN THE MICROSECOND RANGE. Dubovoi, L. V.; Roife, I. M.; Serendenko, E. V.; Stekol'nikov, B. A.; Shapiro, V. B. At. Energ. (USSR); 38: No. 2, 87-89(Feb 1975). (In Russian).

The construction and operating characteristics of an electron accelerator, the power supply of which consists of an inductive storage loop-transformer with a fast foil circuit-breaker, are described. A cold cathode placed in the longitudinal magnetic field of the beam extraction system serves as the source of electrons in the accelerator. At a distance of 0.5 m from the anode aperture of the accelerating gap, there has been obtained a beam of electrons having an energy of 300 keV, 1-kA current amplitude, 2-cm diameter and 5-Ms duration of current pulse. (auth)

7260 EXPERIMENTS ON ACCELERATION OF DEUTERONS AND PROTONS IN AN ELECTRON BEAM TRAVERSING A GAS. Kolomenskii, A. A.; Likhachev, V. M.; Sinil'shchikova, I. V.; Smith, O. A.; Ivanov, V. N. (Lebedev Inst. of Physics, Moscow). Zh. Eksp. Teor. Fiz.; 68: No. 1, 51-54(Jan 1975). (In Russian).

Experiments are carried out on acceleration of deuterons and protons by passing a high current electron beam through a low pressure gas at $\nu/\gamma = 0.37$. The maximal energy of the accelerated deuterons and protons exceeded 2 MeV for an electron energy of 700 keV. The total number of accelerated particles per pulse was $\sim 10^{12}$. (auth)

7261 MICROTRON. Baroncelli, G. Radiaz. Alta Energ.; 13: No. 4, 119-132(Oct 1974). (In Italian).

A general description, based on the MM-10 microtron, is given of the construction characteristics of a microtron. The acceleration and transport systems and the therapy heads are discussed. (JSR)

7262 SPRAYING AND COLLECTION OF CHARGES IN A VAN DE GRAAFF GENERATOR AND CHARACTERISTICS OF A VAN DE GRAAFF GENERATOR UNDER PRESSURIZED CONDITION. Ganguly, A. K.; Saha, A. (Saha Inst. of Nuclear Physics, Calcutta). pp 264-267 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

Auxiliaries and Components

7263 (CONF-750335-51) DESIGN OF THE ZERO GRADIENT SYNCHROTRON BOOSTER II RING MAGNET. Foss, M. H.; Thompson, K.; Lari, R. J.; Simpson, J. (Argonne National Lab., Ill. (USA)). 12 Mar 1975. Contract W-31-109-Eng-38. 5p. Dep. NTIS $4.00.

From particle accelerator conference; Washington, District of Columbia, USA (12 Mar 1975).

The booster program was undertaken at the Argonne National Laboratory Zero Gradient Synchrotron (ZGS) to increase the ZGS beam intensity. By using the transplanted Cornell University 2.2 GeV synchrotron as Booster I, it has been shown at the ZGS that more than one hundred turns of H^- ions can be injected and stripped to H^+ in a booster ring. In Booster II, this intense beam can be accelerated to 500 MeV. Several pulses from the booster, which can run at 60 Hz, will make one ZGS pulse. The Booster II ring magnet, now under construction, is described. (auth)

7264 (CONF-750438-1) GRAPHIC, TIME-SHARING MAGNET DESIGN COMPUTER PROGRAMS AT ARGONNE. Lari, R. J. (Argonne National Lab., Ill. (USA)). 1974. Contract W-31-109-Eng-38. 16p. Dep. NTIS $4.00.

From 5th international conference on magnet technology; Frascati, Italy (21 Apr 1975).

This paper describes three magnet design computer programs in use at the Zero Gradient Synchrotron of Argonne National Laboratory. These programs are used in the time sharing mode in conjunction with a Tektronix model 4012 graphic display terminal. The first program in called TRIM, the second MAGNET, and the third GFUN. (auth)

7265 (CONF-750444-1) PULSED MAGNET SYSTEMS FOR HIGH ENERGY PHYSICS BEAM LINES. Praeg, W. F. (Argonne National Lab., Ill. (USA)). 1975. Contract W-31-109-Eng-38. 9p. Dep. NTIS $4.00.

From conference on magnet technology; Frascati, Italy (21 Apr 1975).

During the past years pulsed magnet systems have been developed at Argonne National Laboratory to transport beam bursts of charged high energy particles of the Zero Gradient Synchrotron (ZGS) facility. The particular features of the switching circuits, the power supplies and the magnets are described. Included are septum, quadrupole, beam shutter and bending magnets with energies ranging from 25 J to 100 kJ. The degree to which magnet current must be repeated and held constant (flattopped) during beam spill varies from +-5 percent for a beam shutter magnet to +-0.005 percent for a bending magnet; the duration of flattop ranges from a few mu s to many ms. (auth)

7266 (JINR-P13-8635) SAWTOOTH CURRENT GENERATOR FOR MESON BEAM STRETCHING SYSTEM OF THE JINR. SYNCHROCYCLOTRON. Danilov, V. I.; Rozanov, E. I.; Smirnov, V. I.; Shestov, A. V. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 10p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

A sawtooth current thyristor generator for energizing the pulsed bump coils is described. The recuperation of a share of energy to supply source has been achieved by means of a transformer overcharge circuit. The investigations were performed at the Laboratory of Nuclear Reactions, JINR. (auth)

7267 (KFK-2094) PHASE SYNCHRONIZATION OF SUPERCONDUCTING ACCELERATOR RESONATORS. Hochschild, G. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Experimentelle Kernphysik). Feb 1975. 143p. (In German). Dep. NTIS (US Sales Only) $10.25.

For the development of the superconducting proton linear accelerator, the phase synchronization of the individual helix resonators was an essential problem because of the small bandwidth and the eigenfrequency instability. The synchronization method required the solution of the following problems: (1) A frequency tuner using electronically switched reactances has been developed, which is able to work at high speed and to withstand high reactive power. (2) The tuning characteristic of the frequency tuner is nonlinear due to switching. Theoretical considerations concerning the synthesis of the absolute phase control loop belonging to the tuner shows that a quasilinear tuning characteristic can be achieved by means of smoothing methods. (auth)

7268 (LA-tr-75-18) MEASURING BEAM PARAMETERS WITH THE HELP OF RESONANT TRANSMITTERS. Kallagov, V. M.; Lomize, L. G.; Rubtsov, B. A.; Sazhin, I. A. Translated by A. D. Cernicek from Tr. Radiotekh. Inst.; No. 16, 246-259 (1974). 21p. Dep. NTIS $4.25.

The possibilities of using resonators excited by a beam to measure the beam parameters are examined. It is shown that with the help of such resonant transmitters it is possible to measure proton current, the current of negative ions accelerated simultaneously with protons, the transverse position of the beam, the mean velocity, the phase position of bunches, the time of flight of particles through the accelerating resonator, the width of the energy spectrum, the profile of the beam and its emittance. The absence of a contact with the beam, which has a decisive significance in accelerators with a large mean current of charged particles is the most important advantage of the resonant transmitters. (auth)

7269 (LBL-3371) SPILL CONTROL AND INTENSITY MONITORING FOR THE BEVATRON-BEVALAC EXTERNAL PARTICLE BEAMS. Barale, J. J.; Crebbin, K. C. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Mar 1975. Contract W-7405-eng-48. 5p. (CONF-750335-57). Dep. NTIS $4.00.

From particle accelerator conference; Washington, District of Columbia, USA (12 Mar 1975).

Time-intensity modulation in beam spill can be of primary concern in some experiments. The major source of this beam structure is from main-guide field-magnet power supply ripple. If the time constants are appropriate, then final control of beam structure can be accomplished by closed loop control of the intensity of beam spill. The response characteristics of the feedback system will determine the final structure. At high beam fluxes signal to noise ratio of beam detectors, in the feedback loop, can be improved by at least four orders of magnitude by using photomultiplier tubes and a water Cherenkov counter in place of the normal secondary emission monitor. At beam fluxes below 10^{10} particles per second (PPS), a plastic scintillator and photomultiplier tube are used in the feedback system. A plastic scintillator and photomultiplier are also used in the beam as intensity monitors. At intensities below about 10^7 PPS standard counting techniques are used. For intensities between 10^8 to 10^9 PPS, the photomultiplier is used as a current source driving an integrating circuit which is then calibrated to read the number of particles per pulse. (auth)

7270 (LBL-3824) FEASIBILITY AND ADVANTAGES OF COMMERCIAL PROCESS I/O SYSTEMS FOR ACCELERATOR CONTROL. Belshe, R. A.; Elischer, V. P.; Jacobson, V. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Mar 1975. Contract W-7405-eng-48. 7p. (CONF-750335-60). Dep. NTIS $4.00.

From particle accelerator conference; Washington, District of Columbia, USA (12 Mar 1975).

Control systems for large particle accelerators must be able to handle analog and digital signals and timing coordination for devices which are spread over a large physical area. Many signals must be converted and transmitted to and from a central control area during each accelerator cycle. Digital transmission is often used to combat common mode and RF interference. Most accelerators in use today have met these requirements with custom process I/O hardware, data transmission systems, and computer interfaces. In-house development of hardware and software has been a very costly and time consuming process, but due to the lack of available commercial equipment, there was often no other alternative. Today, a large portion of these development costs can be avoided. Small control computers are now available off the shelf which have extensive process control I/O hardware and software capability. Computer control should be designed into accelerator systems from the beginning, using operating systems available from manufacturer. With most of the systems programming done, the designers can begin immediately on the applications software. (auth)

7271 (RL-75-010) Q FACTOR MEASUREMENTS ON TANK 1. Sandels, E. G.; Ellis, J. E. (Science Research Council, Chilton (UK). Rutherford Lab.). Jan 1975. 7p. (N/INJ-52). Dep. NTIS (US Sales Only) $4.00.

The equipment, procedure, and results of Q factor measurements on tank 1 at Nimrod are presented. (WHK)

7272 ACCELERATION TUBE FOR A PARTICLE ACCELERATOR. Nagai, A.; Kobashi, Y. (to Mitsubishi Electric Corp.). Japanese Patent 1973-18996/B/. 6 Sep 1969. 3p. (In Japanese).

The present invention relates to improvements in the acceleration tube for use in electrostatic accelerators. The apparatus consists of acceleration electrodes, cylindrical insulators, ring hoops, and high voltage dividing resistances. The voltage dividing resistances in the present invention are flexible helical wires placed in

PARTICLE ACCELERATORS

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Auxiliaries and Components

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7264 (CONF-750438-1) GRAPHIC, TIME-SHARING MAGNET DESIGN COMPUTER PROGRAMS AT ARGONNE. Lari, R. J. (Argonne National Lab., Ill. (USA)). 1974. Contract W-31-109-Eng-38. 16p. Dep. NTIS $4.00.

From 5th international conference on magnet technology; Frascati, Italy (21 Apr 1975).

This paper describes three magnet design computer programs in use at the Zero Gradient Synchrotron of Argonne National Laboratory. These programs are used in the time sharing mode in conjunction with a Tektronix model 4012 graphic display terminal. The first program in called TRIM, the second MAGNET, and the third GFUN. (auth)

7265 (CONF-750444-1) PULSED MAGNET SYSTEMS FOR HIGH ENERGY PHYSICS BEAM LINES. Praeg, W. F. (Argonne National Lab., Ill. (USA)). 1975. Contract W-31-109-Eng-38. 9p. Dep. NTIS $4.00.

From conference on magnet technology; Frascati, Italy (21 Apr 1975).

During the past years pulsed magnet systems have been developed at Argonne National Laboratory to transport beam bursts of charged high energy particles of the Zero Gradient Synchrotron (ZGS) facility. The particular features of the switching circuits, the power supplies and the magnets are described. Included are septum, quadrupole, beam shutter and bending magnets with energies ranging from 25 J to 100 kJ. The degree to which magnet current must be repeated and held constant (flattopped) during beam spill varies from +-5 percent for a beam shutter magnet to +-0.005 percent for a bending magnet; the duration of flattop ranges from a few mu s to many ms. (auth)

7266 (JINR-P13-8635) SAWTOOTH CURRENT GENERATOR FOR MESON BEAM STRETCHING SYSTEM OF THE JINR. SYNCHROCYCLOTRON. Danilov, V. I.; Rozanov, E. I.; Smirnov, V. I.; Shestov, A. V. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 10p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

A sawtooth current thyristor generator for energizing the pulsed bump coils is described. The recuperation of a share of energy to supply source has been achieved by means of a transformer overcharge circuit. The investigations were performed at the Laboratory of Nuclear Reactions, JINR. (auth)

7267 (KFK-2094) PHASE SYNCHRONIZATION OF SUPERCONDUCTING ACCELERATOR RESONATORS. Hochschild, G. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Experimentelle Kernphysik). Feb 1975. 143p. (In German). Dep. NTIS (US Sales Only) $10.25.

For the development of the superconducting proton linear accelerator, the phase synchronization of the individual helix resonators was an essential problem because of the small bandwidth and the eigenfrequency instability. The synchronization method required the solution of the following problems: (1) A frequency tuner using electronically switched reactances has been developed, which is able to work at high speed and to withstand high reactive power. (2) The tuning characteristic of the frequency tuner is nonlinear due to switching. Theoretical considerations concerning the synthesis of the absolute phase control loop belonging to the tuner shows that a quasilinear tuning characteristic can be achieved by means of smoothing methods. (auth)

7268 (LA-tr-75-18) MEASURING BEAM PARAMETERS WITH THE HELP OF RESONANT TRANSMITTERS. Kallagov, V. M.; Lomize, L. G.; Rubtsov, B. A.; Sazhin, I. A. Translated by A. D. Cernicek from Tr. Radiotekh. Inst.; No. 16, 246-259 (1974). 21p. Dep. NTIS $4.25.

The possibilities of using resonators excited by a beam to measure the beam parameters are examined. It is shown that with the help of such resonant transmitters it is possible to measure proton current, the current of negative ions accelerated simultaneously with protons, the transverse position of the beam, the mean velocity, the phase position of bunches, the time of flight of particles through the accelerating resonator, the width of the energy spectrum, the profile of the beam and its emittance. The absence of a contact with the beam, which has a decisive significance in accelerators with a large mean current of charged particles is the most important advantage of the resonant transmitters. (auth)

7269 (LBL-3371) SPILL CONTROL AND INTENSITY MONITORING FOR THE BEVATRON-BEVALAC EXTERNAL PARTICLE BEAMS. Barale, J. J.; Crebbin, K. C. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Mar 1975. Contract W-7405-eng-48. 5p. (CONF-750335-57). Dep. NTIS $4.00.

From particle accelerator conference; Washington, District of Columbia, USA (12 Mar 1975).

Time-intensity modulation in beam spill can be of primary concern in some experiments. The major source of this beam structure is from main-guide field-magnet power supply ripple. If the time constants are appropriate, then final control of beam structure can be accomplished by closed loop control of the intensity of beam spill. The response characteristics of the feedback system will determine the final structure. At high beam fluxes signal to noise ratio of beam detectors, in the feedback loop, can be improved by at least four orders of magnitude by using photomultiplier tubes and a water Cherenkov counter in place of the normal secondary emission monitor. At beam fluxes below 10^{10} particles per second (PPS), a plastic scintillator and photomultiplier tube are used in the feedback system. A plastic scintillator and photomultiplier are also used in the beam as intensity monitors. At intensities below about 10^7 PPS standard counting techniques are used. For intensities between 10^6 to 10^9 PPS, the photomultiplier is used as a current source driving an integrating circuit which is then calibrated to read the number of particles per pulse. (auth)

7270 (LBL-3824) FEASIBILITY AND ADVANTAGES OF COMMERCIAL PROCESS I/O SYSTEMS FOR ACCELERATOR CONTROL. Belshe, R. A.; Elischer, V. P.; Jacobson, V. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Mar 1975. Contract W-7405-eng-48. 7p. (CONF-750335-60). Dep. NTIS $4.00.

From particle accelerator conference; Washington, District of Columbia, USA (12 Mar 1975).

Control systems for large particle accelerators must be able to handle analog and digital signals and timing coordination for devices which are spread over a large physical area. Many signals must be converted and transmitted to and from a central control area during each accelerator cycle. Digital transmission is often used to combat common mode and RF interference. Most accelerators in use today have met these requirements with custom process I/O hardware, data transmission systems, and computer interfaces. In-house development of hardware and software has been a very costly and time consuming process, but due to the lack of available commercial equipment, there was often no other alternative. Today, a large portion of these development costs can be avoided. Small control computers are now available off the shelf which have extensive process control I/O hardware and software capability. Computer control should be designed into accelerator systems from the beginning, using operating systems available from manufacturer. With most of the systems programming done, the designers can begin immediately on the applications software. (auth)

7271 (RL-75-010) Q FACTOR MEASUREMENTS ON TANK 1. Sandels, E. G.; Ellis, J. E. (Science Research Council, Chilton (UK). Rutherford Lab.). Jan 1975. 7p. (N/INJ-52). Dep. NTIS (US Sales Only) $4.00.

The equipment, procedure, and results of Q factor measurements on tank 1 at Nimrod are presented. (WHK)

7272 ACCELERATION TUBE FOR A PARTICLE ACCELERATOR. Nagai, A.; Kobashi, Y. (to Mitsubishi Electric Corp.). Japanese Patent 1973-18996/B/. 6 Sep 1969. 3p. (In Japanese).

The present invention relates to improvements in the acceleration tube for use in electrostatic accelerators. The apparatus consists of acceleration electrodes, cylindrical insulators, ring hoops, and high voltage dividing resistances. The voltage dividing resistances in the present invention are flexible helical wires placed in

helical grooves carved on the outside surface of the cylindrical insulators. The advantages of the present apparatus compared with the prior art in which the resistances are placed outside the cylindrical insulators are as follows: (a) the structure of the present apparatus is easier to construct than the conventional ones; and (b) a larger heat radiation area results in a smaller increment of the ambient temperature, hence the probability of corona discharge is largely reduced. (JA)

7273 MONTE-CARLO CALCULATION OF IRRADIATION DOSE CONTENT BEYOND SHIELDING OF HIGH-ENERGY ACCELERATORS. Mokhov, N. V.; Frolov, V. V. At. Energ. (USSR); 38: No. 4, 226-228(Apr 1975). (In Russian).

The computer program MARS for calculating by the Monte Carlo method the three-dimensional inter-nuclear cascade in accelerators is described. The methods of reducing dispersion and the system of semi-empirical formulas used made it possible to surpass the characteristics of existing programs. The calculations of dose distributions beyond homogeneous and heterogeneous shielding were performed using a synthesis of the results of the MARS and HAMLET programs, which solved the system of transport equations. The calculated results of absorbed and equivalent doses beyond a barrier irradiated by a 1 to 1000 GeV beam of protons are presented. The contribution to the dose of high- and low-energy neutrons, protons, pions, kaons, muons and gamma-quanta as a function of initial energy and thickness, material and composition of shielding was investigated. (auth)

7274 SUPERCONDUCTIVITY, CRYOGENIC, AND VACUUM TECHNOLOGY FOR LINEAR ACCELERATORS. Garwin, E. L. (Stanford Univ., CA). Jap. J. Appl. Phys.; No. Suppl. 2, 183-190(1974).

From 6th international vacuum congress; Kyoto, Japan (25 Mar 1974). See CONF-740353-.

The conventional, 10^{-9} torr-range, ion-pumped vacuum system of the SLAC 3.2-km linear accelerator is briefly described, along with typical performance data. Since polarized electron sources are of increasing importance to high-energy research, the necessary physical environments for such sources are given, and differential pumping and/or isolation systems capable of maintaining those conditions while protecting both source and accelerator are discussed. The development of microwave superconducting linear accelerators is summarized. Emphasis is on vacuum and materials processing techniques necessary to the maintenance of low surface resistance and high electric and magnetic fields. Problems remaining and prospects for their solution are briefly described, along with details of the physical processes taking place at the vacuum-metal interface. (auth)

7275 VACUUM SYSTEM FOR A 30 MV TANDEM VAN DE GRAAFF. Halliday, B. S. (Science Research Council, Warrington, Eng.). Jap. J. Appl. Phys.; No. Suppl. 2, 195-198(1974).

From 6th international vacuum congress; Kyoto, Japan (25 Mar 1974). See CONF-740353-.

The need for ultrahigh vacuum requires accelerator beam tubes made from non organic materials, and pumps and valves placed internally introduce problems of the high gas pressure environment for construction and the high voltage imposes problems of control and monitoring. Specially designed pumps are required to pump high gas flows in the centre terminal and a cryopump configuration for this purpose is described. (auth)

7276 VACUUM AND ULTRAHIGH VACUUM FOR PARTICLE ACCELERATORS AND STORAGE RINGS. Fischer, E. (CERN, Geneva). Jap. J. Appl. Phys.; No. Suppl. 2, 199-204(1974).

From 6th international vacuum congress; Kyoto, Japan (25 Mar 1974). See CONF-740353-.

Particle accelerators operate at pressures of about 10^{-7} torr. Storage rings require 10^{-9} to 10^{-11} torr. The maximum permissible pressure is determined by many perturbing interactions between beam particles and gas molecules. Proton storage rings have additional problems from interactions with layers of gas adsorbed on the chamber walls. Most accelerators and storage rings have a tubular structure with pumps connected in regular intervals. The pressure behaviour in such a system can be calculated from a differential equation, which can be extended to include beam-wall interactions, readsorption and distributed pumps. The systems are pumped by sputter-ion pumps, pre-evacuated by turbopumps and controlled by computers. Radioactivity poses special problems. (auth)

7277 SCHEME OF INITIAL START OF A LARGE VACUUM SYSTEM WITH SPUTTER ION PUMP WITHOUT BAKING PROCEDURE. Horikoshi, G.; Satoh, K.; Mizuno, H. (National Lab. for High Energy Physics, Oho-Machi, Japan). Jap. J. Appl. Phys.; No. Suppl. 2, 205-208(1974).

From 6th international vacuum congress; Kyoto, Japan (25 Mar 1974). See CONF-740353-.

An analysis on an initial start of an ion pump system is made, taking into account the heat generation in the pump and temperature dependences of gas desorption rate of the chamber wall. In the starting process, the status of the system is represented as a point in the $\dot{T}$-T plane. The relative position of the point with respect to the "marginal line", which is derived in the analysis, decides the sign of changing rate of pressure, $\dot{p}$, of the system. (auth)

7278 SIMPLE LOCATOR FOR HIGH ENERGY BEAMS. Dalglish, R. L.; Kelly, J. C. (New South Wales Univ., Kensington, Australia). J. Phys., E (London); 8: No. 2, 107-108(Feb 1975).

A simple quadrant device is described which locates particle beams of energy greater than about 100 keV in complex beam flight systems. The sensing elements are thermistors which respond to the copious energy of the beam rather than to the small beam current usually sensed in comparable locators. The time constant of the locators is about 1 s which is adequate for most installations. The locators detect a beam imbalance of 20 nA between opposite quadrants. This sensitivity has proved to be extremely useful for channelling and backscattering from alkali halides which damage easily and require very small irradiation currents. (auth)

7279 BEAM PROFILE SCANNER. Kerekatte, S. S.; Fernandes, C. V.; Tambwekar, V. V. (Bhabha Atomic Research Centre, Trombay, India). pp 268-270 of Proceedings of the Nuclear Physics and Solid State Pysics Symposium. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

7280 MODEL STUDIES ON SEPARATED SECTORED CYCLOTRONS. Jain, A.; Divatia, A. S. (Bhabha Atomic Research Centre, Trombay, India). pp 284-287 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

7281 EFFECT OF FLAT TOPPING THE rf VOLTAGE WITH THIRD HARMONIC, ON THE ORBITS IN THE CENTRAL REGION OF 224 cm. CYCLOTRON AT CALCUTTA. Bhandari, R. K. (Bhabha Atomic Research Centre, Trombay, India). pp 288-289 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

Ion Sources and Injection and Extraction Systems

Refer also to abstract 7286.

7282 (CONF-740985-, pp 83-85) PENNING-SPUTTERING-ION SOURCE FOR NEGATIVE HEAVY IONS. Andersen, H. H.; Tykesson, P. (Univ. of Aarhus, Denmark). 1974.

From 7th symposium on physics of ionized gases; Rovinj, Yugoslavia (16 Sep 1974).

In seventh Yugoslav symposium on physics of ionized gases.

A radial extraction Penning-type source is described. The source utilizes sputtering of selected materials in a discharge made up of xenon and cesium ions to provide negative ions of the sputtered material for acceleration in a tandem van de Graaff. Diagrams of the source construction are shown, and data are presented for Al, Cu, Ta, and Au negative ion outputs. Transmission through the accelerator is discussed. (GHT)

7283 (LA-tr-75-4) SURFACE-PLASMA SOURCE OF NEGATIVE IONS WITH PENNING GEOMETRY. Dudnikov, V. G. (AN SSSR, Novosibirsk. Inst. Yadernoj Fiziki). Jan 1975. Translation by H. J. Dahlby of Poverkhnostno-Plazmennyi Istochnik Otritsatel'nykh Ionov s Penningovskoi Geometriei. 11p. Dep. NTIS $4.00.

At the Institute of Nuclear Physics of the Siberian Section of the USSR Academy of Sciences a surface-plasma method has been developed for obtaining beams of negative ions which is based on the formation of negative ions during the bombardment by fast ions and atoms of the surface of an electrode in contact

with a gas-discharge plasma. For efficient operation of surface-plasma sources, it is necessary that a set of contradictory requirements be fulfilled: the work function of the emitting surface must be reduced to a value ensuring the adsorption of atoms of the working substance in the form of negative ions and maintained at such a level under conditions of a high-current gas discharge; a flow of the dissociated working substance sufficient to maintain the optimal concentration of its atoms on the emitting surface under intense ion bombardment is necessary; an intense flow of the ions or atoms bombarding the surface with an energy sufficient for efficient desorption of the particles of the working substance in the form of negative ions is needed; the layer of gas and plasma between the emitting surface and the emission aperture must be sufficiently thin that the negative ions emitted from the surface and accelerated by the potential near the electrode are not destroyed in the movement through this layer. These requirements were successfully reconciled in surface-plasma sources with a planotron geometry of the gas-discharge chamber. Construction of the source is described. (WHK)

7284 (LBL-3433) HIGH CHARGE STATE HEAVY ION PRODUCTION FROM A PIG SOURCE. Bex, L.; Clark, D. J.; Ellsworth, C. E.; Flood, W. S.; Gough, R. A.; Holley, W. R.; Meriwether, J. R.; Morris, D. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Mar 1975. Contract W-7405-eng-48. 11p. (CONF-750335-58). Dep. NTIS $4.00.

From particle accelerator conference; Washington, District of Columbia, USA (12 Mar 1975).

The comparison of pulsed vs. dc arc operation for nitrogen and argon shows a shift in charge distribution toward the higher charge states for the pulsed case. Tests with various magnetic field shapes along the arc column show a significant increase in high charge state output for a uniform field compared to the case with a field low at the cathodes. (auth)

7285 HEAVY ION EXTRACTION AND BEAM FORMATION FROM A HOLLOW CATHODE ELECTRON BOMBARDMENT SOURCE. Bhattacharya, P. K.; Wagh, A. G.; Thampi, N. S.; Sarma, N. (Bhabha Atomic Research Centre, Bombay). pp 254-257 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

Ion Optics and Field Calculations

7286 (CONF-750335-53) TRANSPORT OF DC AND BUNCHED BEAMS THROUGH A 25 MV FOLDED TANDEM ACCELERATOR. Milner, W. T.; Alton, G. D.; Hensley, D. C.; Jones, C. M.; King, R. F.; Larson, J. D.; Moak, C. D.; Sayer, R. O. (Oak Ridge National Lab., Tenn. (USA)). 1975. 5p. Dep. NTIS $4.00.

From particle accelerator conference; Washington, District of Columbia, USA (12 Mar 1975).

Studies of beam transport through the planned ORNL 25 MV folded tandem accelerator demonstrate efficient utilization of phase-space acceptance and the feasibility of injecting bunched beams from the tandem accelerator into the Oak Ridge Isochronous Cyclotron (ORIC). Use of a 180^0 bending magnet in the terminal provides outstanding charge state selection and permits better control of the high-energy beam transport than has previously been possible in conventional tandem accelerators. Time spreads introduced in bunched beams by the 180^0 magnet are kept within a 6^0 RF acceptance window at ORIC provided the beam has a crossover in the center of the 180^0 magnet. Ion masses from 12 to 240 amu, pre-injection energies from 150 to 500 keV and terminal voltages from 7.5 to 25 MV were studied for dc beams and beams bunched by various modulation techniques. (auth)

7287 (CONF-750427-1) RING LENS FOR FOCUSING ION BEAMS TO UNIFORM DENSITIES. Johnson, C. H. (Oak Ridge National Lab., Tenn. (USA)). 1975. 28p. Dep. NTIS $4.50.

From meeting of the American Physical Society; Washington, District of Columbia, USA (28 Apr 1974).

An electrostatic lens was designed and built to focus a beam of positive ions into uniform density on a target. The lens has two concentric field regions with a grid separating the inner zero field from the outer radial field. For proper operation the incident ions must emanate with axial symmetry and Gaussian or similar divergence from a small source. An appendix is included on the symmetrization of elliptical beams by a quadrupole singlet lens. (auth)

7288 (GSI-tr-23/74) GENERATION OF ELECTRON RINGS. Stepanov, A. D.; Iwanov, G. A.; Goljutev, J. J. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (F. R. Germany)). Nov 1974. 15p. (In German). INIS.

5 figs.; 9 refs. Translated from the Russian report JINR-P9-8038.

The generation of a rotating electron ring by a sharp decreasing magnetic rf-field is described. Thereby electron rings are produced of length ≤ 5 cm. These were generated by contraction of an electron-bunch of 4 keV energy and a number of 2.5×10^{10} electrons per bunch. The contraction was achieved by magnetic compression in the driftroom, that is, by a step in the magnetic field. (GE)

7289 (JINR-P9-8478) NUMERICAL STUDY OF ELECTROMAGNETIC WAVE SCATTERING BY A LONGITUDINAL-INHOMOGENEOUS RING BUNCH OF CHARGED PARTICLES IN A CIRCULAR WAVEGUIDE. Shvachka, A. B.; Urazakov, E. I. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 15p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

Numerical simulation of the electromagnetic wave scattering by a ring bunch of charged particles is described. A bunch has longitudinal inhomogeneity and is placed into the circular waveguide. The conditions of resonance and instabilities are obtained. The phenomenon of electromagnetic field focusing by a linear inhomogeneous medium was observed. (auth)

7290 (JINR-P9-8625) CALCULATION OF THE FIELDS EXCITED BY MOVING ELECTRON BUNCH IN COAXIAL CAVITY. Mamonov, V. N.; Rubin, S. B. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 17p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The "sewing of fields" method is applied to the calculation of coaxial cavity excitation by electron beams. The constructed FORTRAN program is used for force distribution calculations affecting the beam. The investigation has been performed at the Department of New Acceleration Methods, JINR. (auth)

7291 (KEK-74-6) TUNE SHIFTS OF BETATRON OSCILLATION AND THEIR CORRECTION IN THE SYNCHROTRON. Suzuki, T. (National Lab. for High Energy Physics, Oho, Ibaraki (Japan)). Jun 1974. 11p. INIS.

General expressions for the estimation of tune shifts of betatron oscillation and for their correction are derived up to the fourth order by the averaging method. Some numerical examples are given for the KEK proton synchrotron. (auth)

7292 (RL-75-013) SHIMS FOR THE EPIC PROTOTYPE DIPOLE MAGNET (CALCULATIONS). Armstrong, A. G.; Simkin, J.; Trowbridge, C. W. (Science Research Council, Chilton (UK). Rutherford Lab.). Mar 1975. 5p. (EPIC/MC-69). Dep. NTIS (US Sales Only) $4.00.

The shim dimensions for the EPIC prototype dipole magnet were found by calculations using the magnetostatic computer programs GFUN and TRIM. (auth)

7293 ELIMINATION OF SPHERICAL ABERRATION IN AN AXIAL PLASMA LENS. Lebedev, S. V.; Morozov, A. I. Sov. Phys.-Tech. Phys. (Engl. Transl.); 19: No. 7, 966(Jan 1975).

Translated from Zh. Tekh. Fiz; 44: No. 7, 1547-1548(Jul 1974).

The conditions under which sperical aberration can be eliminated from an axial plasma lens are analyzed. A necessary condition for this elimination is a parabolic potential profile along the magnetic lines of force. (auth)

7294 USEFUL REGION OF VEC QUADRUPOLE MAGNET. Sethi, R. C.; Divatia, A. S. (Bhabha Atomic Research Centre, Bombay). pp 272-274 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

7295 SECOND ORDER EFFECTS IN MAGNETIC SYSTEMS. Bhattaeharya, N. C.; Neogy, P.; Bhandari, R. K.; Divatia, A. S. (Bhabha Atomic Research Centre, Trombay, India). pp 276-279 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

7296 ORBIT DYNAMICS IN THE SIMULATED FIELD OF THE VEC. Neogy, P.; Bhattacharya, N. C.; Chatterjee, S. (Bhabha Atomic Research Centre, Trombay, India). pp 280-283 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

7297 ACHROMATIC PLASMA–LENS SYSTEM. Morozov, A. I.; Lebedev, S. V. Sov. Phys.-Tech. Phys. (Engl. Transl.); 19: No. 7, 967-968(Jan 1975).

Translated from Zh. Tekh. Fiz; 44: No. 7, 1548-1549(Jul 1974).

Annular plasma lenses with axisymmetric focusing fields differ markedly from their vacuum analogs (which focus low-density electron and ion beams). In particular, plasma lenses can display a different velocity dispersion and can be either converging or diverging lenses. Because of these properties systems of plasma lenses without chromatic aberration can be designed, by analogy with ordinary (visible-light) optics. (auth)

Storage Rings

7298 (BNL-20079) SUPERCONDUCTING WIGGLER MAGNET FOR THE PROPOSED BNL ELECTRON STORAGE RING. Dahl, P. F.; Sampson, W. B. (Brookhaven National Lab., Upton, N. Y. (USA)). 7 May 1975. 8p. Dep. NTIS $4.00.

A conceptual design is presented of a superconducting magnet system devised to enhance the synchrotron radiation spectrum from the proposed 1.5 GeV BNL electron storage ring. (auth)

7299 (LBL-3688) ESCAR SUPERCONDUCTING MAGNET SYSTEM. Gilbert, W. S.; Meuser, R. B.; Pope, W. L.; Green, M. A. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). 12 Mar 1975. Contract W-7405-Eng-48. 5p. (CONF-750335-61). Dep. NTIS $4.00.

From particle accelerator conference; Washington, District of Columbia, USA (12 Mar 1975).

Twenty-four superconducting dipoles, each about 1 meter long, provide the guide field for the Experimental Superconducting Accelerator Ring proton accelerator-storage ring. Injection of 50 MeV protons corresponds to a 3 kG control dipole field, and a peak proton energy of 4.2 GeV corresponds to a 46 kG central field. Thirty-two quadrupoles provide focusing. The 56 superconducting magnets are contained in 40 cryostats that are cryogenically connected in a novel series "weir" arrangement. A single 1500 W refrigeration plant is required. Design and testing of the magnet and cryostat system are described. (WHK)

7300 (RL-74-153) IMPROVEMENTS TO INJECTION INTO EPIC. Carne, A. (Science Research Council, Chilton (UK). Rutherford Lab.). Nov 1974. 9p. NTIS.

Proposals are made for improvements in the injection into the planned main storage ring (EPIC) for NIMROD. It is suggested that the injection energy should be raised from 4.8 GeV, as at present envisaged, to 5.325 GeV, and the repetition frequency to 8 Hz. The subject is discussed under the following headings: rating of the booster (ex NINA) magnets and RF system, damping of synchrotron motion in the booster, injection into the main ring at 5.325 GeV, power ratings in the booster at 5.325 GeV, 8 Hz. (UK)

7301 (RL-75-021) LONGITUDINAL HEAD–TAIL IN EPIC. Hereward, H. G. (Science Research Council, Chilton (UK). Rutherford Lab.). Feb 1975. 3p. (EPIC/MC-70). Dep. NTIS (US Sales Only) $4.00.

The effect is discussed: it is concluded that it is likely to be harmless for the EPIC lattice studied, but it is not sure that this is typical for such machines. (UK)

7302 (RL-75-022) RF LOSSES DUE TO RIPPLE IN THE BEAM INDUCED VOLTAGE. Donald, M. H. R. (Science Research Council, Chilton (UK). Rutherford Lab.). Feb 1975. 8p. (EPIC/MC-71). Dep. NTIS (US Sales Only) $4.00.

By considering the frequency components of the beam spectrum, it is easy to see that cavity matching is optimized by matching to the fundamental component only. Unavoidable losses are therefore calculated from the other components of the spectrum. Expressions are derived for extra cavity dissipation and reflected power due to the ripple. By making the simplifying assumptions that the cavity detuning is small, and that the cavity rise time is not very much greater than the bunch separation time, very simple expressions result. When the losses are calculated for EPIC parameters, it is seen that power loss due to this cause is not serious. (auth)

7303 (RL-75-028) COMPUTERS FOR THE EPIC CONTROL SYSTEM. Rosner, R. (Science Research Council, Chilton (UK). Rutherford Lab.). 30 Jan 1975. 7p. (EPIC/MC-72). Dep. NTIS (US Sales Only) $4.00.

It is stated that the paper is intended to contribute towards the discussion to take place within the next few months on the EPIC control system. The tasks to be carried out by the control system are listed. The control system is regarded as a structure on three levels, each having its own computing characteristics: (I) the interface between the control system and the outside world; (II) the communications network; (III) the implementation of the required functions using direct connections to the equipment. The computing requirements at each level are discussed. (UK)

7304 (RL-75-031) NOTES ON A CORNELL-TYPE INJECTION SCHEME FOR USE IN EPIC. Carne, A.; Rees, G. H. (Science Research Council, Chilton (UK). Rutherford Lab.). Mar 1975. 7p. (EPIC/MC-73). Dep. NTIS (US Sales Only) $4.00.

A novel injection system for an 8 GeV e^+-e^- storage ring at Cornell has been described by M Tigner (Improved method for filling an electron storage ring from a synchrotron; Cornell Internal Note). It is attractive to consider the scheme for positron-filling in EPIC, even though many design changes result. Ten versions of the scheme for EPIC are listed, and details are given of the accretion process for two of these. Relative advantages/disadvantages for EPIC, together with estimated filling times, will be given in a separate report. (auth)

7305 (RL-75-046) POSSIBLE TIGNER-TYPE FILLING SCHEMES FOR EPIC. King, N. M. (Science Research Council, Chilton (UK). Rutherford Lab.). Mar 1975. 16p. (EPIC/MC-76). Dep. NTIS (US Sales Only) $4.00.

A summary is given of a proposed injection scheme for a storage ring at Cornell University (Tigner, "Improved Method for Filling an Electron Storage Ring from a Synchrotron" January 1975), involving a sequence of bunch transfers between booster synchrotron and main ring. The whole sequence takes place at the normal main ring injection energy, and is particularly interesting for positron filling. Advantages of using a scheme of this general principle for EPIC are listed. It is pointed out that the basic scheme would need modifying. Detailed discussions follow under the headings: boxcar stacking in main ring; accretion in wanted bunches; and application to EPIC. (UK)

7306 OPTIMIZATION OF A TUBULAR CONDENSATION CRYOPUMP FOR PRESSURES BELOW 10^{-13} TORR. Benvenuti, C.; Blechschmidt, D. (CERN, Geneva). Jap. J. Appl. Phys.; No. Suppl. 2, 77-80(1974).

From 6th international vacuum congress; Kyoto, Japan (25 Mar 1974). See CONF-740353–.

Over the last few years a condensation cryopump was developed at CERN and successfully applied to one crossing region of the Intersecting Storage Rings for protons. Pressures in the 10^{-13} torr range were achieved. The major limitation of this pump is that the H_2 degassing from the 300°K walls of the pump prevents the achievement of pressures below 10^{-13} torr, even though the degassing rate of the stainless steel is 2×10^{-13} torr l/cm^2 sec. Herein a cryopump design of tubular geometry is presented, which incorporates in its vacuum system only a very small fraction of ambient temperature walls, greatly reducing the previous limitation. Furthermore, the total amount of the 300°K radiation reaching the cold baffles is reduced by about two orders of magnitude. This has the double advantage that the baffles can be cooled at lower temperatures and can be allowed to be more "transparent" to radiation and hence to molecules. The new model has been entirely optimised both for molecular and radiation transmission by a Monte Carlo method. It is designed to have a pumping speed of 3000 ls^{-1} for H_2 at the two entrances, an axial conductance providing a pressure drop across the pump of a factor of ten and a limit pressure in the 10^{-14} torr range. (auth)

7307 ULTRAHIGH-VACUUM SYSTEM FOR THE DESY ELECTRON–POSITRON DOUBLE STORAGE RING DORIS. Falland, C.; Goedecke, H.; Hartwig, H.; Kouptsidis, J.; Lewin, H. C.; Muenster, H.; Pingel, H.; Schumann, G.; Schwartz, M. (DESY, Hamburg). Jap. J. Appl. Phys.; No. Suppl. 2, 209-216 (1974).

From 6th international vacuum congress; Kyoto, Japan (25 Mar 1974). See CONF-740353–.

An electron-positron double storage ring for 2×6 A stored beam at 1.8 BeV and 2×0.9 A at 3 BeV has been built and started operating at DESY, the German Electron Synchrotron. The unique double ring structure of 2×288 m length with 2 experimental crossover points allows also particle research with stored electron-electron beams or—after some proposed changes—with electron-proton beams. The main "vacuum problem" of high current electron-positron storage rings is the high desorption rate by synchrotron radiation. With full stored beams a pressure in the low 10^{-8} torr scale is wanted to get a beam lifetime of a few hours due to "Bremsstrahlung". The system has been built as a bakeable UHV-system in order to reach a base pressure of 1×10^{-9} torr or lower without beam. (auth)

Experimental Facilities

Refer also to abstracts 6549 and 6554.

7308 (AERE-M-2710) FEASIBILITY OF OBTAINING VERY SHORT PULSED BEAMS IN THE ENERGY RANGE 300 TO 600 keV FROM THE 3 MeV PULSED VAN DE GRAAFF ACCELERATOR (I.B.I.S.). Porter, D. R.; Waring, S. (UKAEA Research Group, Harwell. Atomic Energy Research Establishment). Mar 1975. 12p. Dep. NTIS (US Sales Only) $4.00. UK 50 pence.

This accelerator has been in use for a number of years and is capable of producing pulsed beams of less than one nanosecond in the energy range 1 to 3 MeV. For this purpose it uses a time compression magnet of the type first described by R. C. Mobley which in conjunction with a suitable beam deflection system is used to compress by a factor of about ten a chopped beam from the accelerator. Such a system could be used as a pulsed source of 14 MeV neutrons for neutron time of flight studies if the minimum working energy is lowered without degrading the time resolution beyond 2 ns. For this pulsed source a tritium target would be bombarded with 300 keV deuterons. The results of investigations into the possible use of I.B.I.S. at this low energy are given. (auth)

7309 (CONF-750307-3) SIMPLY FOCUSED NEUTRINO BEAMS. Benvenuti, A.; Cline, D.; Ford, W. T. (National Accelerator Lab., Batavia, Ill. (USA)). [nd]. 7p. Dep. NTIS $4.00.

From international colloquium of the CNRS on neutrino physics at high energy; Paris, France (18 Mar 1975).

A description of a neutrino beam designed specifically to provide neutrino spectra that can easily be calculated from a hadron production spectrum is given. The beam uses quadrupole focusing with a limited angular acceptance (2 mrad) so that only forward yields are important in determining the neutrino flux spectra. A facility to measure the forward production of pions and kaons is an explicit part of the design. (auth)

7310 (JINR-P8-8602) LIQUID HYDROGEN TARGET WITH A MINIMUM AMOUNT OF THE WALL MATTER AT AN ANGLE OF 2π. Golovanov, L. B.; Mazarskii, V. L. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 9p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

A liquid hydrogen target with a minimum amount of the wall matter at an angle of 2π is described. The minimum amount of the matter is achieved due to the application of foam, as a construction material, for making the vacuum jacket of the target. This permits one to decrease the amount of the wall matter by a factor of 3 to 4 in comparison to the usually used construction materials such as plastic and aluminium. The scheme of the target construction and the distribution curves of the amount of the wall matter at an angle of 0 to 90° for equally reliable vacuum jackets made of foam, plastic and aluminium are presented. The target is supplied with hydrogen from an additional vessel placed above the target. The operating length of the target cell is 800 mm, its diameter is 70 mm, the amount of the wall matter is 0.0013 r. u. (0.0543 g/cm^2) along the beam at the input and output and 0.0050 r. u. (0.2096 g/cm^2) across the beam. The time of continuous operation of the target together with the 50 litre additional vessel without filling up with hydrogen is 48 hours. (auth)

7311 (LBL-3369) NEW HIGH INTENSITY K-BEAM AT THE BEVATRON. Leemann, C.; Morgado, R.; Sah, R. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Mar 1975. Contract W-7405-ENG-48. 8p. (CONF-750335-64). Dep. NTIS $4.00.

From particle accelerator conference; Washington, District of Columbia, USA (12 Mar 1975).

A new high-intensity K-beam has been installed at the Bevatron. The design goal was 2.2 x 10^5 K^+ s per machine pulse at 500 MeV/c, 7.4 x 10^4 stopped K^+ s, and less than 10^{6}pi contamination. Large horizontal acceptance (+- 210 mrad), short length (approximately 10 m) and two stages of separation are the most prominent features of the design. The observed optical properties are in reasonable agreement with the calculations. An evaluation of the performance of this beam if presented. (auth)

7312 (NIRS-R-2, pp 10-12) THICK TARGET B(d,n) REACTION OF 2.8 MeV FOR NEUTRON THERAPY. Inada, T.; Hiraoka, T.; Nishimura, A. Nov 1973. (In Japanese).

In first report on the cancer therapy with high energy particles and the utilization of short lived radionuclides in diagnostics. (National Inst. of Radiological Sciences, Chiba (Japan)).

The production of neutrons by using thick boron targets was investigated. The targets were bombarded by a 2.8 MeV deuteron beam from a Van de Graaff accelerator, and neutrons were produced by the B(d,n) reaction. The energy distribution of the produced neutrons was measured by the time of flight (TOF) method. Angular distribution, lateral dose distribution and percent depth dose distribution were also observed. A pair of scintillators was used for the measurement of the angular distribution, and a pair of ionization chambers was used for the percent depth dose distribution measurement. The time resolution of TOF was 3 n sec. The observed energy distribution of the neutrons from the thick boron targets is shown in comparison with that of the neutrons from a beryllium target. The average energy of neutrons from the boron targets was 5.36 MeV, and LET was about 23 keV/μ. The angular distribution shows strong forward intensity, and the neutron yield was 70% of the neutrons from the Be target. The observed lateral dose distribution shows that it is necessary to develop a special collimation system for the neutrons from boron. The percent depth dose at the depth of 2 cm increased from 50% to 70% in comparison with that of the neutrons from Be. (JA)

7313 (NIRS-R-2, pp 73-77) PROFILE OF THE COLLIMATOR USED FOR D-T NEUTRON THERAPY. Maruyama, T. Nov 1973. (In Japanese).

In first report on the cancer therapy with high energy particles and the utilization of short lived radionuclides in diagnostics. (National Inst. of Radiological Sciences, Chiba (Japan)).

The application of fast neutrons to radiation therapy has become the center of interest through a mine of information on the biological effects of neutrons on malignant tumor and normal tissue, and the development of neutron generating devices and dose measurement. The collimator for the therapy of lung metastatic cancer by D-T neutrons has been manufactured for trial, and its peculiarity was investigated. The hole in this collimator is of tapered shape, and the collimator consists of multilayers of polyethylene (PE) of 5 cm in thickness, steel (S) of 15 cm, PE of 5 cm, S of 5 cm, PE of 5 cm, S of 5 cm and lucite of 1 cm. The dose transmittance of neutrons and gamma-rays through the multilayer was 0.04. The measurement of dose distribution under various conditions in a phantom set in patient position is illustrated. The dose distribution of the fast neutron collimator varied with the materials of the inner wall, therefore the distribution was largely improved by using the steel having good shielding effect for the inner wall. (JA)

7314 (RL-75-019) POLARIZED TARGETS FOR THERMAL NEUTRON BEAMS: A REVIEW. Cox, S. F. J. (Science Research Council, Chilton (UK). Rutherford Lab.). Jan 1975. 15p. Dep. NTIS (US Sales Only) $4.00.

The present and possible future uses of polarized targets in research using thermal neutron beams ($\lambda \approx 1$ to 5 Å) are reviewed. A distinction between "Zeeman" and "dipolar" targets is made to classify these uses; it is based on the modern theory of spin temperature, which is summarized for this purpose. The use of Zeeman targets is discussed in the measurement of the spin dependent nuclear scattering amplitudes, in a possible solution to the phase problem in neutron diffraction, in the polarization analysis of scattered neutrons and in the study of dynamic nuclear polarization itself. The new subject of Pseudo-magnetism is introduced and finally the possible application of dipolar targets to the study of nuclear antiferromagnetism is described. (auth)

7315 ACCESSORY BEAM FLATTENING FILTER FOR THE VARIAN CLINAC-4 LINEAR ACCELERATOR. Boge, R. J.; Tolbert, D. D.; Edland, R. W. (Gunderson Clinic, Ltd., La Crosse, WI). Radiology; 115: No. 2, 475-477(May 1975).

An accessory beam flattening filter (brass disk with critical angles) attaches to the shadow tray of the Clinac-4 linear accelerator, intercepts the x-ray beam, and eliminates higher dose areas at the edges of large fields near the skin surface. This improves the x-ray beam dose distribution within the patient and results in a reduction of dose to normal tissues near the surface. (auth)

7316 EXTENDED FIELD TREATMENT FLATNESS FILTER FOR 4 MV LINEAR ACCELERATORS. Lane, R. G.; Paliwal, B. R. (Univ. of Wisconsin, Madison). Radiology; 115: No. 2, 478-479(May 1975).

An auxiliary flatness filter for large field treatment on 4 MV linear accelerators provides an isodose distribution which does not vary more than 6 percent over the central 80 percent of the axis of a 32 x 32-cm field at 80 cm in air, and at a 2,5, 6, and 12-cm depth in water. This lead disc filter does not affect the central axis depth dose values, and results in only a 16 percent reduction in dose rate on the central field axis. (auth)

7317 CONTROLS AND DOSIMETRY IN THE USE OF ACCELERATORS IN RADIOTHERAPY. Belletti, S. Radiaz. Alta Energ.; 13: No. 4, 133-141(Oct 1974). (In Italian).

The results of an intercollaboration sponsored by the IAEA among 21 European institutes in the measurement of x radiation and electrons produced by electron beams up to 35 MeV are reported. The methods used for the measurement of dose and energy are described. The symmetry and yield of the beam are considered. (JSR)

7318 APPLICATION OF THE HELIUM JET TECHNIQUE TO THE ON-LINE IDENTIFICATION OF NEW NUCLEI BY DETECTING THEIR GAMMA RADIATION. Deprun, C.; Gauvin, H.; Lagarde, B.; LeBeyec (Paris-11 Univ., 91 - Orsay (France). Lab. de Chimie Nucleaire). Rev. Phys. Appl.; 9: No. 5, 895-899 (Sep 1974). (In French).

The method for sweeping along nuclear reaction products using a helium jet was modified for collecting and detecting γ ray-emitters. This method was applied to a ^{12}C ion beam delivered by the Orsay Heavy Ion Cyclotron. The reactions $^{103}Rh(^{12}C,xn)^{115-x}Sb$ were studied between 50 and 90 MeV. Antimony isotopes with masses 113-112-111 and 110 were identified by their γ-rays. Possible improvements of this method are examined. (FR)

PHYSICS (ASTROPHYSICS AND COSMOLOGY)

Cosmic Radiation

Refer also to abstracts 6484, 6704, 7337, 7489, 7507, and 7689.

7319 (N-74-26272) NEW COMPONENT OF COSMIC RAYS OF UNKNOWN ORIGIN AT A FEW MEV PER NUCLEON. Gloecker, G. (Maryland Univ., College Park (USA)). Apr 1974. Contract NAS5-11063. 27p. (NASA-CR-138511; TR-74-097). NTIS $4.50.

From spring meeting of the American Physics Society; Washington, DC (22 Apr 1974).

Recently discovered anomalies in the abundances and energy spectra of quiet time, extraterrestrial hydrogen, helium, carbon, nitrogen, and oxygen require serious revisions of origin theories to account for this new component of cosmic radiation. Abnormally large O/C and N/C ratios, long term intensity variations with time, and radial gradient measurements indicate a nonsolar origin for these 2 to 30 MeV/nucleon particles. Ideas suggested to explain these measurements range from acceleration of galactic source material having an unusual composition to local acceleration of particles within the solar cavity. Observations are at present insufficient to choose between these alternate origin models. (STAR)

7320 SPECTRUM OF RELATIVISTIC ELECTRONS IN COSMIC RAYS. Velinov, P. I. (Geophysical Inst., Sofia). Compt. Rend. Acad. Bulg. Sci.; 27: No. 11, 1497-1500(1974).

A detailed examination has been previously made of the effect of ionization losses on the spectrum and composition of the nuclear component of cosmic rays. A brief discussion is presented on the effect of the ionization losses on the electron component. (WDM)

7321 MEASUREMENT OF THE CHARGE COMPOSITION OF PRIMARY COSMIC RADIATION. Atallah, K. Munich; Univ. Munich (1973). 104p. (In German). INIS.

Thesis.

The experimental arrangement and the operating mode are described. The change measurement unit is composed of a scintillator, a Cherenkov counter, a wire spark chamber to get the angular distribution and absorbers to produce particle cascades. (GE)

Stars

Refer also to abstracts 7378 and 7417.

7322 (AD/A-002231) RADIATIVE TRAPPING AND HYPERFINE STRUCTURE: HCN. Kwan, J.; Scoville, N. Z. (Owens Valley Radio Observatory, Pasadena, Calif. (USA)). 1974. 16p. NTIS $3.25.

The anomalous weakness of the F = 1 to 1 hyperfine component in the J = 1 to 0 emission of interstellar HCN can be caused by radiative trapping in the J = 2 to 1 lines. The anomaly is readily produced if the J = 1 levels are populated largely by collisional excitation from J = 0 to J = 2 followed by radiative decay to J = 1 with the J = 2 to 1 lines optically thick. Regions where the anomaly is found probably have H2 density less than 100000/cc and optical depths in the J = 1 to 0 lines greater than 100. (auth)

7323 (N-74-27341) CROSS SECTION CALCULATIONS OF ASTROPHYSICAL INTEREST. Final Technical Report. Gerjuoy, E. (Pittsburgh Univ., Pa. (USA)). 1974. 7p. (NASA-CR-138600). NTIS $4.00.

Cross sections are discussed for rotational excitation associated with theories of absorption and emission lines from molecules in space with emphasis on H2CO, CO, and OH by collisions with neutral particles such H, H2, and He. The sensitivity of the Thaddeus equation for the H2CO calculation is examined. (STAR)

7324 (N-74-28302) QUASARS, PULSARS, BLACK HOLES, AND HEAO'S. Doolitte, R. F.; Moritz, K.; Whilden, R. D. C. (National Aeronautics and Space Administration, Washington, D. C. (USA)). 1974. 22p. (NASA-EP-120). NTIS.

Astronomical surveys are discussed by large x-ray, gamma ray, and cosmic ray instruments carried onboard high energy astronomy observatories. Quasars, pulsars, black holes, and the ultimate benefits of the new astronomy are briefly discussed. (STAR)

7325 (N-74-31298) REFLECTION AND REPROCESSING OF THE RADIATION OF AN X-RAY SOURCE BY THE ATMOSPHERE OF A NORMAL STAR IN A BINARY SYSTEM. Basko, M. M. 26 Jul 1974. Translation of Russian Preprint-146. (NASA-TT-F-15769). 42p. NTIS $5.25.

The transfer of x-ray radiation was numerically investigated in a plane-parallel semi-infinite atmosphere irradiated by an externally incident flux of hard x-ray quanta. Photoabsorption and Compton scattering processes were taken into account. The values of the albedo and the spectral, polarization, spatial, and temporal characteristics of the reflected signal were found. The results obtained are discussed in connection with the specific systems Her X1 and Cyg X3. The possibility is pointed out of the existence of sources weak in the h upsilon approximate to the 2 to 6 keV region and bright in the h upsilon approximate to the 15 to 20 keV region. Results indicate the Her X1 fits this pattern during the 24 days out of 36 days when the pulsar rays are not incident on the earth and it is possible to receive only the radiation reflected by the surface of HZ Her. The nature of the pulsations of the optical radiation of HZ Her is also discussed. (STAR)

7326 (N-74-32265) MODEL ATMOSPHERES FOR COOL STARS. Johnson, H. R. (National Center for Atmospheric Research, Boulder, Colo. (USA)). Jan 1974. 101p. (NASA-CR-139752; NCAR-TN/STR-95). NTIS $8.25.

An extensive series of model atmospheres for cool stars having a wide range in chemical compositions is given. Model atmospheres (temperature, pressure, density, etc.) are tabulated, along with emergent energy flux distributions, limb darkening, and information on convection for selected models. The models are calculated under the usual assumptions of hydrostatic equilibrium, constancy of total energy flux (including transport both by radiation and convection) and local thermodynamic equilibrium. Some molecular and atomic line opacity is accounted for as a straight mean. While cool star atmospheres are regimes of complicated physical conditions, and these atmospheres are necessarily approximate, they should be useful for a number of kinds of spectral and atmospheric analysis. (auth) (STAR)

7327 ELECTRON RUNAWAY IN TURBULENT ASTROPHYSICAL PLASMAS. Houghton, M. J. (Newcastle-upon-Tyne Univ., Eng.). Planet. Space Sci.; 23: No. 3, 409-418(Mar 1975).

An astrophysical electron acceleration process is described which involves turbulent plasma effects: the acceleration mechanism will operate in collision free magnetoactive astrophysical plasmas when ion-acoustic turbulence is generated by an electric field which acts parallel to the ambient magnetic lines of force. The role of anomalous (ion-sound) resistivity is crucial in maintaining the parallel electric field. It is shown that, in spite of the turbulence, a small fraction of the electron population can accelerate freely, i.e., runaway, in the high parallel electric potential. The number density $n^{(B)}$ of the runaway electron component is of order $n^{(B)} \simeq n/2(c_s/U_{\parallel})^2$, where n = background electron number density, c_s = ion-sound speed and $U_{\parallel}$ = relative drift velocity between the electron and ion populations. The runaway mechanism and the number density $n^{(B)}$ do not depend critically on the details of the nonlinear saturation of the ion-sound instability. (auth)

7328 CALCULATION OF SUPERNOVA LIGHT CURVES. Falk, S. W. Jr. Austin, TX; Univ. of Texas (1974). 170p. University Microfilms Order No. 75-4361.

Thesis (Ph. D.).

A brief discussion of the observational data pertaining to supernova phenomena is presented, along with a summary of prior attempts to account for various of these features. The physics and numerical techniques appropriate to the treatment of coupled hydrodynamics and radiation transport are discussed. The methods of pseudo-viscosity, equilibrium photon diffusion and frequency dependent photon transport in matter in local thermodynamic equilibrium are used to calculate the passage of strong shock waves through extended red giant-like stellar envelopes, in an attempt to account for the main features of observed supernova. Models are presented which show good agreement with the general characteristics of observed supernova events, including velocities of expansion, temperatures, and overall light curve morphology. The results suggest that a rough systemization of these features with physical parameters such as mass, radius, composition, and explosion energy may be possible. (Diss. Abstr. Int., B)

7329 FREE PRECESSION OF NEUTRON STARS: SOME PLAIN TRUTHS, CAUTIONARY REMARKS, AND ASSORTED SPECULATIONS. Pines, D. (Univ. of Illinois, Urbana); Shaham, J. Comments Astrophys. Space Phys.; 6: No. 2, 37-44(1974).

A brief summary is presented of present understanding of free precession in neutron stars. Attention is called to some truths concerning such wobble motion and then one describes some current efforts to devise mechanisms for exciting neutron star wobble with particular attention to the Crab and Vela pulsars and to Her X-1. (JFP)

7330 AFTERCLAP OF DEGENERATE CARBON IGNITION. Buchler, J. R. (Yeshiva Univ., New York); Mazurek, T. J.; Truran, J. W. Comments Astrophys. Space Phys.; 6: No. 2, 45-55(1974).

The discussion of the afterclap of degenerate carbon ignition in stellar evolution includes hydrodynamic studies, studied alternatives to total disruption, and further alternatives. (JFP)

7331 TRAJECTORIES AND RADIATION OF PARTICLES INCIDENT ON A ROTATING BLACK HOLE. Yakovlev, D. G. (Ioffe Inst. of Physics and Tech., Leningrad). Zh. Eksp. Teor. Fiz.; 68: No. 2, 369-376(Feb 1975). (In Russian).

The trajectories of particles incident on a rotating black hole with small impact parameters are examined. The frequency and angular distribution of the energy of the radiation emitted by relativistic particles moving along the trajectories is shown (for the simple model of scalar radiation) to depend on the metric of the black hole. (auth)

7332 UBVRI PHOTOMETRY OF VARIABLE RED DWARF EMISSION OBJECTS. Martins, D. H. Gainesville, FL; Univ. of Florida (1974). 153p. University Microfilms Order No. 74-27,880.

Thesis (Ph. D.).

A review of the history and nature of small scale variability of red dwarf emission line stars is presented. This discussion is accompanied by a description of equipment developed for the purpose of expediting data acquisition for photoelectric photometry of faint stars. Data obtained at the Kitt Peak Observatory, the Lowell Observatory, and the Rosemary Hill Observatory of the University of Florida are tabulated and analyzed to determine their implications with respect to the known variability of four stars. BY Draconis, GT Pegasus, FF Andromeda, and LP101-15 (an eclipsing binary) are studied. LP101-15 and BY Draconis were observed on the Johnson UBVRI system at Kitt Peak while BY Draconis, GT Pegasus, and FF Andromeda were observed on the Johnson RI system at the Lowell Observatory. UBV"R" observations were carried out on all four objects at Rosemary Hill Observatory since the spring of 1972. Analysis of the data centers on discussions relative to the proposed "spot model" to account for the observed variations in V, R, B–V, V–R, and R–I. After allowance is made for the influence of flare activity (found to be very important), the spot model appears to be adequate in its predictions when compared with observations. A period of 0.63398 day is supported for LP101-15, and a possible secondary minimum is proposed (this secondary eclipse would be less than 0.05 magnitude deep in V), assuming the above period to be correct. This star also appears to exhibit small scale variability with a period of 0.63398 day implying synchronous rotation and revolution. Flare activity is seen to be very important on this star as well. Continued observation of these stars and similar objects is suggested, since further data are essential for complete understanding of their behavior. (Diss. Abstr. Int., B)

Quasi-Stellar, Radio, and X-Ray Sources

7333 SOME ASPECTS OF OBSERVATIONAL RADIOASTRONOMY IN THE MILLIMETER WAVELENGTHS RANGE. Blum, E. J. (Meudon Observatoire, France). pp 31-36 of Fourth Meeting of the Committee of European Solar Radio Astronomers. Schanda, E. (ed.). Meudon, France; Observatoire de Paris (1974).

From fourth conference of the Committee of European Solar Radio Astronomers; Bern, Switzerland (4 Mar 1974).

Factors controlling or otherwise affecting the development of observational radio astronomy in the millimeter-wavelength range are reviewed. Special attention is given to the influences of the atmosphere and site and to equipment limitations, particularly those of receivers and antennas. It is shown that, even with the best receivers available, the atmosphere, the relatively low fluxes of radio sources, and the size of the antenna dishes set fairly severe limits. (IAA)

7334 SOLAR RADIO STUDIES BY CESRA MEMBERS. Fokker, A. D. (Sterrewacht Sonnenborgh, Utrecht). pp 37-45 of Fourth Meeting of the Committee of European Solar Radio Astronomers. Schanda, E. (ed.). Meudon, France; Observatoire de Paris (1974).

From fourth conference of the Committee of European Solar Radio Astronomers; Bern, Switzerland (4 Mar 1974).

Review of the current state of European solar radio astronomy research, and discussion of potential cooperation opportunities and research priorities. Special attention is given to such topics as microwave bursts, chromosphere-corona transition phenomena, scattering of radio radiation, metric heliography, fine structure in type-IV emission, and studies of type-III bursts. (IAA)

Solar Phenomena

7335 (N-74-26269) ACCELERATION OF HEAVY NUCLEI IN SOLAR FLARES. Sakurai, K. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center). May 1974. 20p. (NASA-TM-X-7066; X-693-74-142). NTIS $4.00.

The overabundance of heavy nuclei in solar cosmic rays of energy approximately less than 5 Mev/nucleon is explained by taking into account the pre-flare ionization states of these nuclei in the region where they are accelerated. A model is proposed which considers two-step accelerations associated with the initial development of solar flares. The first step is closely related to the triggering process of flares, while the second one starts with the development of the explosive phase. Further ionization of medium and heavy nuclei occurs through their interaction with keV electrons accelerated by the first-step acceleration. It is suggested that the role of these electrons is important in producing fully ionized atoms in the acceleration regions. (auth)

7336 (N-74-29237) HIGH-RESOLUTION SOLAR X-RAY STUDIES. Final Scientific Report, 1 February 1970-30 June 1974. Blake, R. L. (Chicago Univ., Ill. (USA). Enrico Fermi Inst.). 30 Jun 1974. 13p. (NASA-CR-138904). NTIS $4.00.

Two high resolution solar x-ray payloads and their launches on Aerobee rockets with pointing system are described. The payloads included 5 to 25A x-ray spectrometers, multiaperture x-ray cameras, and command box attitude control inflight by means of a television image radioed to ground. Spatial resolution ranged from five arc minutes to ten arc seconds and spectral resolution ranged from 500 to 3000. Several laboratory tasks were completed in order to achieve the desired resolution. These included development of techniques to align grid collimators, studies of the spectrometric properties of crystals, measurements of the absorption coefficients of various materials used in x-ray spectrometers, evaluation of the performance of multiaperture cameras, and development of facilities. (STAR)

7337 (N-74-32244) HEAVY SOLAR COSMIC RAYS IN THE JANUARY 25, 1971 SOLAR FLARES. Pellerin, C. J. Jr. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center). Aug 1974. 32p. (NASA-TM-X-70731; X-662-74-231). NTIS $4.75.

A detailed study of the charge composition of heavy solar cosmic rays measured in the January 25, 1971 solar flare including differential fluxes for the even charged nuclei from carbon through argon is presented. The measurements are obtained for varying energy intervals for each nuclear species in the energy range from 10 to 35 MeV/nucleon. In addition, abundances relative to oxygen are computed for all the above nuclei in the single energy interval from 15 to 25 MeV/nucleon. This interval contains measurements for all of the species and as a result requires no spectral extrapolations. An upper limit for the abundance of calcium nuclei is also presented. These measurements, when combined with other experimental results, enable the energy dependence of abundance measurements as a function of nuclear charge to be discussed. It is seen that at energies above about 10 MeV/nucleon, the variations of abundance ratios are limited to about a factor of 3 from flare to flare, in spite of large variations in other characteristics of these solar events. (auth)

7338 (N-74-32271) SOLAR RADIOMETRY AT MILLIMETER WAVELENGTHS. Interim Report. Henze, W. (Teledyne Brown Engineering, Huntsville, Ala. (USA)). May 1974. Contract NAS8-26442. 30p. (NASA-CR-120426; EE-SSL-1812). NTIS $4.50.

In the area of resolution enhancement, the use of Fast Fourier Transform programs was investigated for possible application to millimeter wavelength maps of the sun. A difficulty arises with the La Posta maps in that they are limited to 35 arc-minutes square while the smeared out solar image is larger than that. A list of possible cometary emission lines near 13 millimeters is presented. Although preparation of the list was inspired by the appearance of Comet Kohoutek, the results are applicable to any future comet. The brightness temperature of the sun at 8.6 millimeters was measured using the moon as a calibration source.

The result does not confirm a deep absorption feature as apparently observed by earlier workers. (auth)

7339 (OAP-360) SOLAR NEUTRINOS. Ulrich, R. K. (California Inst. of Tech., Pasadena (USA); California Univ., Los Angeles (USA)). Jun 1974. 14p. California Inst. of Tech., Pasadena.

The current status of the experimental efforts by Davis to detect neutrinos from the sun is reviewed from the point of view of the theory of solar models. The essential physical input for a standard model of the sun is presented. Ten different hypothetical explanations of the discrepancy between the theoretically expected ^{37}Ar production rate and the observed production rate are discussed. None of these hypotheses are entirely satisfactory. One, the low Z model, is marginally attractive but it requires the sun to have a very unusual chemical composition. The errors in the fluxes from the standard model and the low Z model resulting from errors in the input data lead to ^{37}Ar production rates of 5.6 ± 1.8 and $1.4 \pm 0.35 \times 10^{-36}$ atoms/target atom/sec, respectively. (auth)

7340 ENERGETIC SOLAR PARTICLES IN INTERPLANETARY SPACE. II. Amundsen, R. (Bergen Univ.). Fra Fys. Verden; 37: No. 1, 15-22(1975). (In Norwegian).

The anisotropy of the particle flux 45°E of the sun is due to corotation of the particles with the sun. The electron flux is remarkably isotropic in the early phase, later it becomes analogous to the ion flux. A model with these simplifying assumptions, a smooth field to a distance $r = a \geq$ IAU from the sun, a shell with isotropic diffusion from $r = a$ to a free flight boundary at $r = b$, is introduced to give a more consistent description of the particles' behavior. The adiabatic cooling of the particles is due to interaction with the interplanetary field. Recent results suggest that the free flight boundary is fictitious and that convection and adiabatic cooling in the solar wind alone determine the decay time profile. A delayed event is characterized by its occurrence late in, or completely isolated from, a prompt event, time variations without velocity dispersion, strongly anisotropic radiation with maximum flux along the magnetic field lines a much steeper energy spectrum. Delayed events are closely connected with shock waves in the interplanetary space. Storage of energetic particles in the immediate vicinity of the sun was suggested as an explanation of the duration of some prompt and also delayed events. Lateral diffusion near the solar surface seem necessary to explain some prompt events, but other mechanisms introduced in other connections can also play a role. In conclusion it may be said that satellite and space probe measurements have led to a good understanding of the propagation of cosmic radiation in the solar system. (auth)

7341 POLARIZATION OF SOLAR FLARE X RAYS. Korchak, A. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio-Wave Propagation, Moscow). Comments Astrophys. Space Phys.; 6: No. 2, 57-62(1974).

A critical discussion is given of the theoretical and experimental investigation of solar x-ray polarization. (JFP)

7342 PROCEEDINGS OF THE FOURTH MEETING OF THE COMMITTEE OF EUROPEAN SOLAR RADIO ASTRONOMERS, BERN, SWITZERLAND, MARCH 4–8, 1974. Schanda, E. (ed.). Meudon, France; Observatoire de Paris (1974). 164p.

Some aspects of observational radio astronomy in the millimeter wavelength range, the evolution of magnetic fields and unstable solar plasmas, and the brightness distribution at 80 MHz of a fluctuating type-IV source are among the topics covered in papers concerned with recent research in solar radio astronomy. Other topics covered include the directivity of type-III bursts, approximations of spectral features of gyrosynchrotron emission, and a digitally controlled solar radio spectrograph. Separate abstracts are prepared for 21 papers. (IAA)

For abstracts of individual papers see: 7333, 7334, and 7343–7361.

7343 INTEGRATED SOLAR FLARE OBSERVATIONS. de Feiter, L. D. (Rijksuniversiteit, Utrecht). pp 13-15 of Fourth Meeting of the Committee of European Solar Radio Astronomers. Schanda, E. (ed.). Meudon, France; Observatoire de Paris (1974).

From fourth conference of the Committee of European Solar Radio Astronomers; Bern, Switzerland (4 Mar 1974).

The observable frequency range of the electromagnetic spectrum emitted by a solar flare has recently been extended both at the low- and the high-frequency end. At very low frequencies it is now possible to observe the generation of radio waves, by a beam of energetic electrons or by a shockwave, in the solar-wind plasma near the earth's orbit where the plasma frequency is about 30 kHz. At very high frequencies the products of nuclear reactions produced by flare-accelerated energetic nuclei can be studied through the intensities of the nuclear gamma-ray lines at frequencies near 5×10^{20} Hz. To this range of frequencies in the electromagnetic spectrum, accessible for flare observations, must be added an equally impressive range of particles, below 1 keV, to relativistic energies for both electrons and nuclei. Although the interpretation of particle observations in general is hampered by the often incompletely known conditions near the source region as well as in interplanetary space, such observations provide a means of direct sampling of the composition of a particularly interesting component of the flare material. (IAA)

7344 EVOLUTION OF MAGNETIC FIELDS AND UNSTABLE SOLAR PLASMAS. Kuperus, M. (Rijksuniversiteit, Utrecht). pp 17-19 of Fourth Meeting of the Committee of European Solar Radio Astronomers. Schanda, E. (ed.). Meudon, France; Observatoire de Paris (1974).

From fourth conference of the Committee of European Solar Radio Astronomers; Bern, Switzerland (4 Mar 1974).

Consideration of the magnetic fields concentrated at the solar surface in small magnetic knots located at the boundaries of supergranulation and in sunspots and their surrounding faculae, and review of some of the recent and current theories attempting to explain them. A study of these complex fields may provide a clue to the understanding of the mechanism of solar flares which are still the most mysterious of all solar phenomena. (IAA)

7345 LONG BASE LINE INTERFEROMETRY OF THE SUN AT CENTIMETER WAVELENGTHS. Kundu, M. R. (Univ. of Maryland, College Park). pp 21-30 of Fourth Meeting of the Committee of European Solar Radio Astronomers. Schanda, E. (ed.). Meudon, France; Observatoire de Paris (1974).

From fourth conference of the Committee of European Solar Radio Astronomers; Bern, Switzerland (4 Mar 1974).

The three-element interferometer of the National Radio Astronomy observatory and the two-element interferometer of the Hat Creek Observatory have been used to observe the fine structure of the sun at 11.1-, 3.7-, and 1.3-cm wavelengths. Solar active regions have been synthesized at 11.1- and 3.7-cm wavelengths with angular resolutions of 9 and 3 arc sec, respectively. Structural components on the scale of a few seconds of arc have also been detected in the quiet-sun and flare regions. (auth)

7346 GRADIENT IN THE CORONAL SCATTERING POWER AS A POSSIBLE CAUSE OF POSITIONAL DRIFT OF TYPE I BURSTS. Fokker, A. D. (Sterrewacht Sonnenborgh, Utrecht). pp 57-58 of Fourth Meeting of the Committee of European Solar Radio Astronomers. Schanda, E. (ed.). Meudon, France; Observatoire de Paris (1974).

From fourth conference of the Committee of European Solar Radio Astronomers; Bern, Switzerland (4 Mar 1974).

An attempt is made to account for the drift observed by Bougeret (1973) in the space-time structure of certain type-I bursts occurring predominantly in positions near or outside the limb after the peak intensity has been reached. It is suggested that this post-maximum drift may be due to the existence of a gradient in the coronal scattering power. (IAA)

7347 CORRELATION ANALYSIS IN THE SEARCH OF SMALL LINEAR POLARIZATION IN SOLAR MICROWAVE BURSTS. Maetzler, C. (Univ., Bern). pp 61-70 of Fourth Meeting of the Committee of European Solar Radio Astronomers. Schanda, E. (ed.). Meudon, France; Observatoire de Paris (1974).

From fourth conference of the Committee of European Solar Radio Astronomers; Bern, Switzerland (4 Mar 1974).

The digital data of the solar microwave polarization of 20 bursts have been analyzed with a correlation technique based on the assumption of time-dependent Faraday rotation. Apart from one burst with weak deviation from circular polarization, no linear polarization has been found, leading to an upper limit of the mean degree of linear polarization of 0.2%. (auth)

7348 POLARIZATION FINE STRUCTURE OF TYPE III SOLAR RADIO BURSTS ON SHORT METER WAVELENGTHS AND ITS RELATION TO THE NATURE OF THE RADIATION AND SOURCE PARAMETERS. Slottje, C. (Stichting Radiostraling van Zon en Melkweg, Dwingeloo, Netherlands). pp 71-80 of Fourth Meeting of the Committee of European Solar Radio Astronomers. Schanda, E. (ed.). Meudon, France; Observatoire de Paris (1974).

From fourth conference of the Committee of European Solar Radio Astronomers; Bern, Switzerland (4 Mar 1974).

Study of the polarization profiles resulting from recently reported observations of fundamental and harmonic radiation. The results include the findings that: (1) the fundamental fre-

quency of type-III bursts exhibits a specific time profile for the degree of circular polarization; (2) the harmonic radiation is not likely to show more than a slight, almost constant polarization or zero polarization degree throughout its life, and should any fine structure be observable, it is likely to be in burst tail peaks; and (3) at least some of the type-III bursts around 300 MHz are of a fundamental nature. (IAA)

7349 UNUSUAL CORONAL SCATTERING OF RADIO WAVES DURING THE LAST SOLAR MAXIMUM. Gorgolewski, S. (Univ., Torun, Italy). pp 81-85 of Fourth Meeting of the Committee of European Solar Radio Astronomers. Schanda, E. (ed.). Meudon, France; Observatoire de Paris (1974).

From fourth conference of the Committee of European Solar Radio Astronomers; Bern, Switzerland (4 Mar 1974).

Some of the results of the 1970 Cal Tech coronal occultation experiment are reviewed and compared with previous observations. It is shown how important high frequency observations are both in regard to the unusual structure of coronal electron irregularities and the possibility of observing refraction. (IAA)

7350 LANDAU DAMPING OF TYPE III BURSTS BY THE INTERPLANETARY ELECTRONS OF HIGH ENERGY. Aubier, M. G. (Meudon Observatoire, France). pp 87-89 of Fourth Meeting of the Committee of European Solar Radio Astronomers. Schanda, E. (ed.). Meudon, France; Observatoire de Paris (1974).

From fourth conference of the Committee of European Solar Radio Astronomers; Bern, Switzerland (4 Mar 1974).

Using the electron velocity distribution function based on the quiet-time observations published by Lin et al. (1972), the Landau damping of plasma waves at 1 AU is computed. It is shown to be faster than the damping by electron-ion collisions. The implications of this finding are discussed. (IAA)

7351 CENTER TO LIMB VARIATION OF THE CHARACTERISTICS OF THE DECAMETRIC NOISE STORMS. Moller-Pedersen, B. (Meudon Observatoire, France). pp 91-93 of Fourth Meeting of the Committee of European Solar Radio Astronomers. Schanda, E. (ed.). Meudon, France; Observatoire de Paris (1974).

From fourth conference of the Committee of European Solar Radio Astronomers; Bern, Switzerland (4 Mar 1974).

Study of the characteristics of type-III, type-IIIb, drift-pair, and other decametric storms on the basis of observations performed with a decametric spectrograph from January 1973 through January 1974. The results indicate that the occurrence of type-III and type-IIIb storms is not determined by the structure of the magnetic field density over the active region. Both of these burst types are simultaneously excited and emitted in different directions, type III radially and type IIIb more parallel to the surface of the sun. (IAA)

7352 CORRELATIONS BETWEEN VARIOUS CHARACTERISTICS OF SOLAR ERUPTIVE EVENTS. Schoechlin, W.; Stocker, F.; Schanda, E. (Univ., Bern). pp 95-101 of Fourth Meeting of the Committee of European Solar Radio Astronomers. Schanda, E. (ed.). Meudon, France; Observatoire de Paris (1974).

From fourth conference of the Committee of European Solar Radio Astronomers; Bern, Switzerland (4 Mar 1974).

An analysis is made of the relations between a number of characteristic quantities of eruption phenomena as observed in the microwave, the optical, and the x-ray spectrum. A study was made of the correlations of the characteristics of 64 microwave simple impulsive bursts (namely, maximum intensity, degree of polarization, emitted microwave energy and spectral behavior) with the maximum intensity, area, and emitted energy of the H alpha-flare as well as with the x-ray intensity and the photospheric magnetic field. The results of this correlation analysis and preliminary conclusions are discussed. (auth)

7353 HIGH RESOLUTION INTERFEROMETRIC OBSERVATIONS OF ACTIVE REGIONS AT 2.8 cm. II. The Study of the Active Region McMath 11976. Felli, M.; Pampaloni, P.; Tofani, G. (Observatorio Astrofisico, Arcetri, Italy). pp 113-118 of Fourth Meeting of the Committee of European Solar Radio Astronomers. Schanda, E. (ed.). Meudon, France; Observatoire de Paris (1974).

From fourth conference of the Committee of European Solar Radio Astronomers; Bern, Switzerland (4 Mar 1974).

The radio structure of the active region McMath 11976 has been investigated with an east-west resolution of 16 seconds of arc at a wavelength of 2.8 cm. Six bright components were found with angular sizes of the order of 20 seconds of arc. Their positions are compared with the H alpha and magnetic structure of the active region. The derived brightness temperatures reach unusual values, up to 6,000,000 K for the brightest component. (auth)

7354 HIGH RESOLUTION INTERFEROMETRIC OBSERVATIONS OF ACTIVE REGIONS AT 2.8 cm. III. Equatorial Limb Structure of the Quiet Sun. Felli, M.; Tofani, G.; Scandiffio, E. (Observatorio Astrofisico, Arcetri, Italy). pp 119-121 of Fourth Meeting of the Committee of European Solar Radio Astronomers. Schanda, E. (ed.). Meudon, France; Observatoire de Paris (1974).

From fourth conference of the Committee of European Solar Radio Astronomers; Bern, Switzerland (4 Mar 1974).

The equatorial quiet limbs of the sun are observed with a high resolving power. The results are compared with the theoretical response of the instrument to a uniform brightness distribution model. The preliminary analysis supports the hypothesis of a uniform brightness distribution near the limbs. (auth)

7355 SOME PRELIMINARY RESULTS ON THE DISTRIBUTION OF TYPE I BURSTS AT 408 MHz. Abrami, A. (Osservatorio Astronomico, Trieste, Italy). pp 123-130 of Fourth Meeting of the Committee of European Solar Radio Astronomers. Schanda, E. (ed.). Meudon, France; Observatoire de Paris (1974).

From fourth conference of the Committee of European Solar Radio Astronomers; Bern, Switzerland (4 Mar 1974).

The positions of type I bursts at 408 MHz are obtained by means of a simple correlation interferometer. Their distribution across the solar disk, for three periods of solar activity, shows the complex structure of the emitting regions and allows the determination of the source heights in the solar corona. (auth)

7356 COHERENT RADIATION MECHANISM FOR TYPE IV dm RADIO BURSTS. Juijpers, J. (Rijksuniversiteit, Utrecht). pp 133-136 of Fourth Meeting of the Committee of European Solar Radio Astronomers. Schanda, E. (ed.). Meudon, France; Observatoire de Paris (1974).

From fourth conference of the Committee of European Solar Radio Astronomers; Bern, Switzerland (4 Mar 1974).

An interpretation is presented of the decimetric type IV continuum (240 to 350 MHz) which occurred on Mar. 6, 1972. It is shown that in a stationary situation and for weak magnetic fields a loss cone instability develops which generates Langmuir waves preferably perpendicular to the magnetic field. Efficient conversion into electromagnetic waves will take place through induced scattering, if the number density of the weak relativistic (less than 1 MeV) electrons exceeds 600,000 per cu cm. This requirement is less stringent than for an explanation in terms of synchrotron radiation. (auth)

7357 PROGRESS IN STREAMER PHYSICS. Weber, W. J. (Rijksuniversiteit, Utrecht). pp 137-146 of Fourth Meeting of the Committee of European Solar Radio Astronomers. Schanda, E. (ed.). Meudon, France; Observatoire de Paris (1974).

From fourth conference of the Committee of European Solar Radio Astronomers; Bern, Switzerland (4 Mar 1974).

An evaluation is made of models of coronal streamers published so far, and of the improvements and useful applications of these models. The model published by Pneuman is evaluated numerically in some detail, and it is found that this model is applicable for several coronal problems although the physical reality must be distrusted. In particular, it is found that an earlier published conclusion, that Pneuman's streamer is not appropriate for the propagation of particle beams which are invoked to generate type III radio bursts, is premature. (auth)

7358 NEUTRAL LINE ABSORBING FEATURES. Heyvaerts, J. (Meudon Observatoire, France); Priest, E. pp 147-151 of Fourth Meeting of the Committee of European Solar Radio Astronomers. Schanda, E. (ed.). Meudon, France; Observatoire de Paris (1974).

From 4th conference of the Committee of European Solar Radio Astronomers; Bern, Switzerland (4 Mar 1974).

Recent observations of "neutral line absorbing features" in the solar atmosphere are briefly recalled. It is suggested that, as new magnetic flux emerges, a current sheet builds up between the new and old flux. When the sheet reaches a length of about 500 km, the thermal conduction becomes sufficiently ineffective for a thermal instability to occur. The resulting compression and inflow of plasma, is observed in H alpha on the disk as a neutral line absorbing feature. It is shown that the electric field developed in the accompanying collisionless tearing mode instability may accelerate electrons to high enough energies to produce the type III burst which usually occurs at the same time as the absorbing feature. (auth)

7359 POSSIBLE MECHANISM FOR TYPE V BURSTS. Benz, A. O. (Technische Hochschule, Zurich). pp 157-158 of Fourth Meeting of the Committee of European Solar Radio Astronomers. Schanda, E. (ed.). Meudon, France; Observatoire de Paris (1974).

From 4th conference of the Committee of European Solar Radio Astronomers; Bern, Switzerland (4 Mar 1974).

A model for type V bursts is suggested in which the beam of type III electrons is unstable against an ion cyclotron instability. The resulting waves are able to scatter a part of the fast electrons to more transverse orbits, which may prolong the plasma wave production at a given height and thus the radio emission of a given frequency. (auth)

7360 APPROXIMATIONS FOR SPECTRAL FEATURES OF GYROSYNCHROTRON EMISSION. Tarnstrom, G. L. pp 159-165 of Fourth Meeting of the Committee of European Solar Radio Astronomers. Schanda, E. (ed.). Meudon, France; Observatoire de Paris (1974).

From 4th conference of the Committee of European Solar Radio Astronomers; Bern, Switzerland (4 Mar 1974).

The behavior of the power emitted in the gyrosynchrotron radiation of a single electron is examined in the approximation scheme of Wild and Hill (1971). New approximate expressions are derived for the spectral index and peak frequency both for vacuum and Razin-suppressed spectra, appropriate to applications for the study of narrow-band type IV bursts. (author)

7361 ONE-DIMENSIONAL TRUE BRIGHTNESS DISTRIBUTION OBTAINED WITH A MINIMUM REDUNDANCY LINEAR ARRAY. Felli, M.; Pampaloni, P. (Osservatorio Astrofisico, Arcetri, Italy). pp 167-171 of Fourth Meeting of the Committee of European Solar Radio Astronomers. Schanda, E. (ed.). Meudon, France; Observatoire de Paris (1974).

From 4th conference of the Committee of European Solar Radio Astronomers; Bern, Switzerland (4 Mar 1974).

The information provided by a minimum-redundancy interferometer is specified, and the problem of the recovery of the one-dimensional brightness distribution both in the spatial frequency domain and in the angular domain, is discussed for the case of one or more Gaussian sources in the field of view. (auth)

7362 ABSOLUTE TRANSITION PROBABILITIES FOR Ni I AND THE SOLAR NICKEL ABUNDANCE. Lennard, W. N. Pasadena, CA; California Inst. of Tech. (1974). 212p. University Microfilms Order No. 74-24,446.

Thesis (Ph. D.).

Absolute transition probabilities have been measured for 97 lines from 11 levels in Ni I using the lifetime and branching ratio technique. Relative transition probabilities have been determined for 6 lines out of 2 levels whose lifetimes have been measured elsewhere. Equivalent widths were measured from the Kitt Peak Preliminary Solar Atlas for 48 of the lines for which absolute transition probabilities were measured. An empirical solar curve of growth has been constructed for Ni I to test the consistency of the transition probability and equivalent width measures. The solar data have been used to calculate value for the photospheric Ni Abundance A/sub Ni/ equals 6.29 +- 0.2 based on the results of the transition probability measurements. A new transition ($z^5G_3^0 - e^3G_3$, lambda 4633.031) has been observed in the Ni I spectrum. (Diss. Abstr. Int., B)

7363 SOLAR NEUTRINO PUZZLE. Barnothy, J. M. Nature (London); 252: No. 5485, 666-667(20 Dec 1974).

Reference is made to Davis who set a bound to the flux of neutrinos arriving from the Sun, using a technique based on the reaction $^{37}Cl(\nu, e^-)^{37}Ar$. The latest experimental results by this method correspond to 1 SNU (solar neutrino unit = 1×10^{-36} neutrino capture per ^{37}Cl nucleus per second), whereas solar models yield values higher by an order of magnitude. An explanation is here offered for this discrepancy between theory and experiment on the basis of the assumption that strong interactions between nuclear particles are of a gravitational nature. It is assumed that within the range of nuclear forces the gravitational constraint is 38 orders of magnitude larger than normal. For distances larger than the Compton wavelength of the proton (2.1×10^{-14}cm) its value then decreases exponentially to a normal value, but for distances within 0.21 fermi the gravitational force will behave as a short range, charge independent, nonexchange force, responsible for the strong interactions between nucleons. It is stated that the hypothesis advanced might be tested at accelerators where neutrinos and antineutrinos of energy 0.5 to 5 GeV can be produced. (UK)

Galaxies

7364 (N-74-28305) COLLISIONLESS RELAXATION IN SPIRAL GALAXY MODELS. Hohl, F. (National Aeronautics and Space Administration, Langley Station, Va. (USA). Langley Research Center). Jun 1974. 20p. (NASA-TN-D-7561; L-9385). NTIS $3.00.

The increase in random kinetic energy of stars by rapidly fluctuating gravitational fields (collisionless or violent relaxation) in disk galaxy models is investigated for three interaction potentials of the stars corresponding to point stars, rod stars of length 2 kpc, and uniform density spherical stars of radius 2 kpc. To stabilize the galaxy against the large scale bar forming instability, a fixed field corresponding to a central core or halo component of stars was added with the stars containing at most 20 percent of the total mass of the galaxy. Considerable heating occurred for both the point stars and the rod stars, whereas the use of spherical stars resulted in a very low heating rate. The use of spherical stars with the resulting low heating rate will be desirable for the study of large scale galactic stability or density wave propagation, since collective heating effects will no longer mask the phenomena under study. (STAR)

7365 (N-74-28307) OPTICAL RADIATION FROM THE CRAB PULSAR. Sturrock, P. A.; Petrosian, V.; Turk, J. S. (Stanford Univ., Calif. (USA). Inst. for Plasma Research). Jun 1974. 35p. (NASA-CR-138573; SU-IPR-574). NTIS $4.75.

Possible mechanisms for producing the optical radiation from the Crab pulsar are proposed and discussed. There are severe difficulties in interpreting the radiation as being produced by an incoherent process, whether it be synchrotron radiation, inverse-Compton radiation or curvature radiation. It is proposed therefore that radiation in the optical part of the spectrum is coherent. In the polar cap model, a small bunch of electrons and positrons forms near each primary electron as a result of the pair-production cascade process. Ambient electric fields give rise to energy separation, as a result of which either the electrons or positrons will dominate the radiation from each bunch. The roll-off in the infrared is ascribed to synchrotron absorption by electrons and positrons located between the surface of the star and the force-balance radius. Various consequences of this model, which may be subjected to observational test, are discussed. (STAR)

Cosmology

Refer also to abstracts 7587, 7588, and 7983.

7366 (BNL-tr-600) VELOCITY DISTRIBUTION OF PLASMA IONS AND SOLAR NEUTRINOS. Vasil'ev, S. S.; Kocharov, G. E.; Levkovskii, A. A. Translated by S. J. Amoretty from Izv. Akad. Nauk SSSR, Ser. Fiz.; 39: No. 2, 310-315(1975). 14p. Dep. NTIS $4.00.

The role of distortion of the Maxwell distribution of high energy solar neutrino flux, which could not be detected, is discussed. The distortion of the velocity distribution of the colliding particle pairs when the energy of the colliding particles in the c.m. system does not exceed a certain value which is called the cutoff energy. A standard solar model with a central temperature of 14.9 million degrees is used. (JFP)

7367 (COO-3071-136) NEUTRINO COSMOLOGY. Bludman, S. A. (Pennsylvania Univ., Philadelphia (USA). Dept. of Physics). 1974. 15p. Dep. NTIS $4.00.

Cosmological data are reviewed suggesting that the universe may be open and dominated by neutrinos and gravitons rather than by baryons. The thermal history of the Lepton Era is investigated incorporating the effects of neutral currents, additional neutrinos, and a small neutrino mass. In the canonical version of Big Bang cosmology (equal numbers of neutrinos and antineutrinos), the neutrino number and energy density is, like that of photons, gravitationally insignificant unless the neutrino has a small mass (approximately 10 eV). The neutrino sea can be cosmologically significant if it is degenerate (so that the net leptonic or muonic charge is nonzero) with approximately ~ x 10^5 neutrinos (or antineutrinos) per cc. This density homogeneously spread out is still so low that even the most energetic cosmic ray protons will not be stopped, even if neutral currents exist with the usual weak strength. If these degenerate neutrinos have a small mass approximately 0.5 eV, they will condense into degenerate neutrino superstars of the size and mass of galactic clusters. If neutral currents make the (e nu)(e nu) coupling 5 x greater than what it is in V-A theory, nucleosynthesis commences a little earlier than conventionally assumed. This increases the cosmological ^4He abundance predicted only slightly from Y equals 0.27 to Y equals 0.29. The effect of neutral currents on neutrino processes in stars is reviewed. (auth)

7368 CATASTROPHES IN THE CANONICAL QUANTIZATION IN AN EXPANDING UNIVERSE. Castagnino, M. (Univ., Buenos Aires); Verbeure, A.; Weder, R. A. Nuovo Cim., 26B: No. 2, 396-408(11 Apr 1975).

By means of a natural method for the quantization of a massless real scalar field in an expanding universe, it is proved for a Friedman-like model that the time evolution is not implementable in four dimensions, yielding some pathological behavior of the operator of the total number of particles. This pathological behavior is not present in the two-dimensional model. (auth)

7369 AUDIOFREQUENCY VIBRATIONS AND GRAVITY-WAVE DETECTORS. Fitzgerald, E. R. (Johns Hopkins Univ., Baltimore). Nature (London); 252: No. 5485, 638-640(20 Dec 1974).

Nonelastic audiofrequency vibrational modes in aluminum (and other metals) are suggested as a possible reason for the differences reported by various observers using large aluminum alloy bars (or disks) as gravity-wave detectors. Loading of suspended gravity-wave detector bars resulting from the gravitational attraction of the earth is also sufficient to produce the small stresses required for the self-generation of audio-frequency sounds (acoustic emission) in materials. Both the nonelastic mode response and acoustic emission frequencies depend critically on the exact microstructure and/or residual stress state of a bar. (auth)

7370 COSMOLOGICAL PRINCIPLES. II. Physical Principles. Harrison, E. R. (Univ. of Massachusetts, Amherst). Comments Astrophys. Space Phys.; 6: No. 2, 29-35(1974).

The discussion of cosmological principles covers the uniformity principles of the laws of physics, the gravitation and cognizability principles, and the Dirac, creation, chaos, and bootstrap principles. (JFP)

7371 DYNAMIC METHOD FOR THE RECEPTION OF GRAVITATIONAL RADIATION BY QUADRUPOLE DETECTORS. Tsyplakov, V. V.; Khavroshkin, O. B. pp 11-13 of Teoriya Otnositel'nosti i Gravitatsiya. Stanyukovich, K. P. (ed.). Moscow; Izdatel'stvo Nauka Glavnaya Redaktsiya Vostochnoi Literatury (1974). (In Russian)

From meeting of Society of Naturalists on theory of relativity and gravitation; Moscow, USSR (26 Apr 1974). See CONF-740493--.

A dynamic method for the detection of gravitational waves is proposed, based on the use of two similar quadrupole detectors placed perpendicularly to each other. A time difference in the damping of the oscillations under the influence of gravitational waves would be an indication of gravitational radiation. (JSR)

7372 THERMAL NOISE OF HOMOGENEOUS CORES. Gusak, A. I.; Kuznetsov, A. I.; Tsyplakov, V. V.; Khavroshkin, O. B. pp 14-17 of Teoriya Otnositel'nosti i Gravitatsiya. Stanyukovich, K. P. (ed.). Moscow; Izdatel'stvo Nauka Glavnaya Redaktsiya Vostochnoi Literatury (1974). (In Russian)

From meeting of Society of Naturalists on Theory of Relativity and Gravitation; Moscow, USSR (26 Apr 1974). See CONF-740493--.

An analysis of the noise of a homogeneous core shows that longitudianl thermal fluctuations of Weber-type detectors do not interact with other types of thermal fluctuations and that the evaluation made for longitudinal fluctuations agrees well with available data. (JSR)

Planetary Phenomena

Refer also to abstracts 5906 and 7323.

7373 (N-74-20468) SATURN LAUNCHED X-RAY ASTRONOMY EXPERIMENT. Volume 1, S-027, Final Program Report. (SCI Electronics, Inc., Huntsville, Ala. (USA)). 11 Mar 1971. Contract NAS8-21015. 90p. (NASA-CR-120166). NTIS $7.50.

The S-027 X-Ray Astronomy Experiment originally proposed in early 1966 was developed to detect x-rays in the 2 to 10 keV range. Both a prototype unit and flight unit were constructed with the prototype unit also serving as the engineering model, the qualification test unit, and after refurbishment, as the back-up flight unit. Two ground support equipment consoles were built to verify the experiment operation. A photograph of one experiment package with its ground support equipment is shown. The S-027 experiment was scheduled for launch in 1968/69 and although both units were completed and tested to the extent that either would be ready for the scheduled launch, delays in the space program resulted in a launch date slip of several years. When the 1968/69 launch delay became official, provisions were made for storage of the two experiment packages at SCI Electronics in Huntsville, Alabama until a new launch date could be established. (auth)

7374 (N-74-26275) EARTH AS A RADIO SOURCE: TERRESTRIAL KILOMETRIC RADIATION. Progress Report. Gurnett, D. A. (Iowa Univ., Iowa City (USA). Dept. of Physics and Astronomy). Feb 1974. Contract NASr-11074. 54p. (NASA-CR-138520). NTIS $5.25.

Radio wave experiments on the IMP-6 and 8 satellites have shown that the earth emits very intense electromagnetic radiation in the frequency range from about 50 kHz to 500 kHz. A peak intensity the total power emitted in this frequency range is about 1 billion watts. The earth is, therefore, a very intense planetary radio source, with a total power output comparable to the decametric radio emission from Jupiter. This radio emission from the earth is referred to as terrestrial kilometric radiation. Terrestrial kilometric radiation appears to originate from low altitudes (less than 3.0 Re) in the auroral region. Possible mechanisms which can explain the generation and propagation of the terrestrial kilometric radiation are discussed. (STAR)

7375 (N-74-26277) REGOLITH HISTORY FROM COSMIC-RAY-PRODUCED ISOTOPES. Fireman, E. L. (Smithsonian Astrophysical Observatory, Cambridge, Mass. (USA)). Apr 1974. 16p. (NASA-CR-134261; SAO-404-069). NTIS $4.00.

A statistical model is given for soil development relating meteoroid impacts on the moon to cosmic-ray-produced isotopes in the soil. By means of this model, the average lunar mass loss rate during the past 14 aeons is determined to be 170 g/sq cm aeon and the soil mixing rate to be approximately 200 cm/aeon from the gadolinium isotope data for the Apollo 15 and 16 drill stems. The isotope data also restrict the time variation of the meteoroid flux during the past 14 aeons. (auth)

7376 (N-74-27338) TEMPERATURE AND ELECTRICAL CONDUCTIVITY OF THE LUNAR INTERIOR FROM MAGNETIC TRANSIENT MEASUREMENTS IN THE GEOMAGNETIC TAIL. Dyal, P.; Parkin, C. W.; Daily, W. D. (National Aeronautics and Space Administration, Moffett Field, Calif. (USA). Ames Research Center). 1973. 36p. (NASA-TM-X-70083). NTIS $5.00.

Magnetometers were deployed at four Apollo sites on the moon to measure remanent and induced lunar magnetic fields. Measurements from this network of instruments were used to calculate the electrical conductivity, temperature, magnetic permeability, and iron abundance of the lunar interior. Global lunar fields due to eddy currents, induced in the lunar interior by magnetic transients in the geomagnetic tail field, were analyzed to calculate an electrical conductivity profile for the moon. This profile is generally consistent with conductivity results from transient response analysis in the solar wind, using data measured on the lunar nightside. A temperature profile is calculated from conductivity. Temperature rises rapidly with depth to 1100 K at 200 km depth, then less rapidly to 1800 K at 1000 km depth. Velocities and thickness of the earth's magnetopause and bow shock are estimated from simultaneous magnetometer measurements. (STAR)

7377 (N-74-27350) HIGH RESOLUTION OBSERVATIONS OF JOVIAN MAGNETOSPHERIC MICROWAVE SYNCHROTRON EMISSION. Final Technical Report. D'Addario, L. R.; Wernecke, S. J. (Stanford Univ., Calif. (USA)). Jun 1974. 50p. (NASA-CR-138778). NTIS $5.50.

High resolution radio observations of Jupiter were investigated with the use of the Stanford synthesis telescope. The best fit disk was computed from the emission of Jupiter and the residual brightness, due to nonthermal mechanisms was measured. (STAR)

7378 (N-74-28259) INTERPLANETARY SHOCK WAVES ASSOCIATED WITH SOLAR FLARES. Chao, J. K.; Sakurai, K. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center). Jun 1974. 48p. (NASA-TM-X-70683; X-693-74-168). NTIS $5.50.

The interaction of the earth's magnetic field with the solar wind is discussed with emphasis on the influence of solar flares. The geomagnetic storms are considered to be the result of the arrival of shock wave generated by solar flares in interplanetary space. Basic processes in the solar atmosphere and interplanetary space, and hydromagnetic disturbances associated with the solar flares are discussed along with observational and theoretical problems of interplanetary shock waves. The origin of interplanetary shock waves is also discussed. (STAR)

7379 (N-74-28260) COORDINATE TRANSFORMATIONS FOR STUDIES OF INTERACTIONS BETWEEN INTERPLANETARY AND GEOMAGNETIC FIELDS. Burch, J. L.; Janetzke, R. W. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center). Apr 1974. 19p. (NASA-TM-X-70684; X-621-74-179). NTIS $4.00.

A graphical procedure is provided for performing coordinate transformations between the geocentric-solar-equatorial, geocentric-solar-ecliptic and geocentric-solar-magnetospheric coordinate systems. The procedure is designed to facilitate

intercomparison of previous studies of interactions between interplanetary and geomagnetic fields that made use of these coordinate systems. The interaction in the geocentric-solar-magnetosphere system was shown to give the most consistent results. (STAR)

7380 SCIENTIFIC RESULTS FROM THE PIONEER 11 MISSION TO JUPITER. Opp, A. G. (National Aeronautics and Space Administration, Washington, DC). Science; 188: No. 4187, 447-448(2 May 1975).

The results from the Pioneer 11 mission to Jupiter include the magnetosphere, magnetic field, and radiation belts, the planet and atmosphere, and the postencounter. (JFP)

7381 ISOTOPE ANALYSIS ON IRON METEORITES WITH ION PROBE MASS SPECTROMETER. Nishimura, H.; Okano, J. (Osaka Univ.). Jap. J. Appl. Phys.; No. Suppl. 2, 399-401 (1974).

From 6th international vacuum congress; Kyoto, Japan (25 Mar 1974). See CONF-740353-.

In order to investigate the isotopic effect of nickel which might have been brought into use by the diffusion of nickel isotopes during the crystallization of an iron meteorite, the isotopic ratio $^{58}Ni/^{60}Ni$ and the nickel concentration were measured with the ion probe mass spectrometer. Krypton and argon ions were used as primary ions, whose energy was 5 keV. The diameter and the current of the primary ion beam were 250 μm and 2×10^{-7} A on the surface of the sample target. Three iron meteorites, Odessa, Canyon Diablo, and Hembury were analyzed. Two former samples belong to the class of coarse octahedrite, and the latter one medium octahedrite. The point-to-point analysis was carried out every 0.25 mm or 0.5 mm in the range of about 4 mm on the surface of the sample. The distribution of $^{58}Ni/^{60}Ni$ was likely to correlate to the nickel concentration in the case of Odessa and Canyon Diablo. (auth)

7382 PRIMORDIAL RADIOELEMENT CONCENTRATIONS IN ROCKS AND SOILS FROM TAURUS-LITTROW. Eldridge, J. S.; O'Kelley, G. D.; Northcutt, K. J. (Oak Ridge National Lab., TN). Geochim. Cosmochim. Acta; 2: 1025-1033(1974).

From 5th lunar conference; Houston, TX (18 Mar 1974).

Primordial radioelement (K, Th, and U) concentrations were determined nondestructively by gamma spectrometry in thirteen soil and thirteen rock samples from the returned sample collection from Taurus-Littrow. Soil samples investigated were: 71131, 71501, 73121, 73131, 73141, 73221, 73241, 73261, 73281, 76501, 78501, 79221, and 79261. Rock samples were: 70135, 70185, 70215, 4, 71135, 71136, 71175, 71566, 73215, 73255, 73275, 76295, 78597, and 79155. Concentrations of K, Th, and U in the soil samples were found to have a narrow range of values for seven light-mantle soils that were distinctly different from those values for the other six soils in this study. The Th content of the light soils is the same as that found from the orbiting gamma-ray spectrometer determination of Trombka et al. (1973). Little or no variation of primordial radioelement content was observed as a function of depth, color, or texture in trench samples. Variations of Th/U and K/U were observed in three types of basaltic rocks. These observations lend geochemical evidence to the speculation that two or three separate subfloor basalt units were sampled at the Taurus-Littrow site. Correlation of K/U mass ratios with potassium content of the Apollo 17 materials indicates a possible two component mixing of subfloor basalt and KREEP as end members to produce soil and breccias at Taurus-Littrow. (auth)

PHYSICS (ATMOSPHERIC)

Auroral and Ionospheric Phenomena

Refer also to abstract 6534.

7383 (COM-74-50276-31) AURORAL ELECTROJET MAGNETIC ACTIVITY INDICES AE (11) FOR 1969. Allen, J. H.; Abston, C. C.; Morris, L. D. (World Data Center A for Solar-Terrestrial Physics, Boulder, Colo. (USA)). Feb 1974. 147p. (UAG-31; NOAA-74031106). National Climatic Center, Asheville, NC 28801 $0.75.

The auroral electrojet index (ae) is discussed, and a brief description is given of the derivation of 11-station 2.5-min ae indices for 1969. Tables are given of hourly average indices for each day of the year, of the stations making the main contribution to the hourly indices, and of the average monthly quiet-time level of horizontal fields (H) at each magnetic observatory. Graphs of the index variations are included for each day of 1969. (auth)

7384 (N-74-26903) LABORATORY STUDIES ON THE EXCITATION AND COLLISIONAL DEACTIVATION OF METASTABLE ATOMS AND MOLECULES IN THE AURORA AND AIRGLOW. Zipf, E. C. (Pittsburgh Univ., Pa. (USA). Space Research Coordination Center). Feb 1974. 32p. (NASA-CR-138614). NTIS $4.75.

The aeronomy group at the University of Pittsburgh is actively engaged in a series of coordinated satellite, sounding rocket, and laboratory studies designed to expand and clarify knowledge of the physics and chemistry of planetary atmospheres. Three major discoveries have been made that will lead ultimately to a complete and dramatic revision of our ideas on the ionospheres of Mars, Venus, and the earth and on the origin of their vacuum ultraviolet airglows. The results have already suggested a new generation of ionosphere studies which probably can be carried out best by laser heterodyning techniques. Laboratory studies have also identified, for the first time, the physical mechanism responsible for the remarkable nitric oxide buildup observed in some auroral arcs. This development is an important breakthrough in auroral physics, and has military ramifications of considerable interest to the Department of Defense. This work may also shed some light on related NO and atomic nitrogen problems in the mesosphere. (STAR)

7385 TWILIGHT VARIATION OF THE AIRGLOW. III. OH-6329 A Airglow. Misawa, K. (Defence Academy, Yokosuka, Kanagawa, Japan). Rep. Ionosphere Space Res. Jap.; 27: No. 3, 97-103(Sep 1973).

Zenith records of the OH-6329 Å airglow intensities have been obtained at Yokosuka (geographic lat. 35°15′, long. 139°44′; geomagnetic lat. +25.0°, long. 205.7°) from November 1972 to July 1973. The two-color photometry was used. The use of a photometer with a refrigerator for photomultiplier resulted in reliable data on the airglow. Inflection points of the intensity enhancement in twilight were found, which seemed to indicate the beginning of the twilight activity of the OH-6329 Å airglow emission. (auth)

7386 SOLAR–TERRESTRIAL DISTURBANCES OF AUGUST 1972. Part XIV. LF/MF/HF Radio Wave Propagation Disturbances. Wakai, N. (Radio Research Lab., Nakaminato, Ibaraki, Japan); Ouchi, C.; Nemoto, C.; Kogaku, T. Denpa Kenkyusho Kiho; 19: No. 103, 361-366(Jul 1973). (In Japanese).

The earthstorm which occurred early in August 1972 caused remarkable disturbances in short-distance radio circuits in which the 1-hop-E sky-wave component predominated. This paper presents the variations of field intensities at 5.0, 2.5, 1.85 MHz and 750 kHz, as well as the intensity and phase of 100 kHz signals. Ionograms during the night from August 5 to 6 exhibited the occurrence of the nighttime E layer (intermediate layer) in association with the increase of absorption of HF and MF waves and the phase advance of LF signal. (auth)

7387 STRATIFICATION OF IONOSPHERIC PLASMA IN THE REGION OF REFLECTION OF THE ORDINARY RADIO WAVE. Vas'kov, V. V.; Gurevich, A. V. (Lebedev Inst. of Physics, Moscow). JETP Lett.; 20: No. 8, 241-242(20 Oct 1974).

Translated from Zh. Eksp. Teor. Fiz., Pis'ma Red.; 20: No. 8, 529-533(20 Oct 1974).

The mechanism of the instability that leads to stratification of the ionospheric plasma in the region of reflection of a high power radio wave is considered. (auth)

Magnetospheric Phenomena

7388 (N-74-26185) AVERAGE MOTION OF A CHARGED PARTICLE IN A DIPOLE FIELD. Chen, A. J.; Stern, D. P. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center). May 1974. 15p. (NASA-TM-X-70668; X-602-74-166). NTIS $4.00.

The numerical representation of the average motion of a charged particle trapped in a geomagnetic field is developed. An assumption is made of the conservation of the first two adiabatic invariants where integration is along a field line between mirror points. The averaged motion also involved the parameters defining the magnetic field line to which the particle is attached. Methods involved in obtaining the motion in the equatorial plane of model magnetospheres are based on Hamiltonian functions. The restrictions imposed by the special nature of the dipole field are defined. (STAR)

PHYSICS (ATOMIC AND MOLECULAR)

Beams and Their Reactions

Refer also to abstracts 7139 and 7868.

7389 (AD/A-003005) SPUTTERED THIN FILM RESEARCH. Semiannual Technical Report No. 5, 15 April 1972-30 September 1974. Shuskus, A. J.; Quinn, D. J.; Paradis, E. L.; Berak, J. M.; Cullen, D. E. (United Aircraft Corp., East Hartford, Conn. (USA). Research Labs.). Nov 1974. Contract N00014-72-C-0415. 211p. (UARL-N-921337-15). NTIS $7.25.

The reactive RF sputtering technique was applied to the preparation of a wide variety of materials. Single crystal films of ZnO, TiO_2, WO_3 AlN and GaN were grown on one or more of the insulating crystalline substrates of ^{303}Al, Mg^{303}Al, SIC and $LiNBO_3$. Data on the deposition parameters, structure and optical waveguiding characteristics of the heteroepitaxial structures are presented. Reactive sputtering using sublimed arsenic as the sputtering gas inside a heated vacuum chamber was used to grow epitaxial films of GaAs. The controlled growth of single crystal alloys of Ga (1−X) Al (X) as at low temperatures was also demonstrated. Structural, optical and electrical characteristics of these films are presented. Conditions were determined for the deposition of amorphous neodymium ultraphosphate films. Low loss optical wave guide structures were fabricated. Charge storage characteristics of MIS structures were investigated. These employed a composite insulator formed by sputtering 1000A of strontium titanate over a 20A thick thermally grown silicon dioxide layer on silicon. (auth)

7390 (CEA-CONF-2783) A U.H.F. ION SOURCE USING ELECTRON CYCLOTRON RESONANCE. Grando, J. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France)). 1974. 14p. (In French). INIS.

From 4th AVISEM 74 international congress. Uses of ionic and electronic processes; Toulouse, France (8 Oct 1974).

An experimental study is presented of a 2.46 GHz microwave discharge leading to an ion source model forming a resonating cavity to which is associated a plasma expansion chamber. In the case of hydrogen, densities of 10^{11} cm^{-3} are obtained and 100 eV electronic temperatures; the extracted ions current depends on the pressure, magnetic field and hf power. With 500 W, it is possible to obtain intensities exceeding 40 mA. The results are completed by an assessment of the gas yield (n approximately 50%) and the mass analysis of the extracted beam. (FR)

7391 (CONF-7306115-P2, pp C.XVII1-C.XVII7) FUTURE DEVELOPMENTS IN CHARGED PARTICLE BEAM OPTICS. Carey, D. C. (National Accelerator Lab., Batavia, IL). 1973.

From 3rd international colloquium on advanced computing methods in theoretical physics; Marseille, France (25 Jun 1973).

In third international colloquium on advanced computing methods in theoretical physics, Marseille, June 25−29, 1973. (Centre National de la Recherche Scientifique, 13 - Marseille (France). Centre de Physique Theorique).

Computation for the design of a charged-particle beam line for the transmission of particles in order to determine the magnet characteristics necessary to achieve certain desired beam properties at the end of the system are elaborated as regards the first and second order terms in the solution. (JFP)

7392 (CONF-740985-, pp 79-82) SOURCE FOR INTENSE MULTIPLY CHARGED ION BEAMS OF REFRACTORY METALS. Winter, H. (Technische Hochschule, Vienna). 1974.

From 7th symposium on physics of ionized gases; Rovinj, Yugoslavia (16 Sep 1974).

In seventh Yugoslav symposium on physics of ionized gases.

A new, compact, multiply charged ion source of the "DuoPIGatron" configuration using sputtering has been constructed. Measurements with various refractory metal working substances show considerable yields of high ion charge states while the source operates without particular problems. The ion source lifetime depends only on the wear-out of the working substance metal insert. By choice of suitable metal compounds or alloys, rare metals can also be processed at relatively low costs. (5 figs., 1 table) (auth)

7393 (CONF-740985-, pp 87-90) MONTE-CARLO CALCULATIONS OF THE MULTIPLE SCATTERING OF VARIOUS IONS WITH DIFFERENT ENERGIES IN THIN FILMS. Guettner, K.; Muenzenberg, G.; Zienert, J. (Physikalisches Institut, Giessen, Ger.). 1974.

From 7th symposium on physics of ionized gases; Rovinj, Yugoslavia (16 Sep 1974).

In seventh Yugoslav symposium on physics of ionized gases.

Expanded calculation procedure and range of applicability of earlier Monte Carlo calculations is reported. Multiple scattering distributions of fission fragments are calculated and compared with a known experiment. Tests of the program in the keV region are also reported. (GHT)

7394 (CONF-740985-, pp 95-97) MULTIPLE SCATTERING OF ENERGETIC HEAVY IONS IN SOLIDS: THE INFLUENCE OF TARGET STRUCTURE. Andersen, H. H. (Univ. of Aarhus, Denmark); Boettiger, J.; Knudsen, H.; Moeller-Petersen, P.; Wohlenberg, T. 1974.

From 7th symposium on physics of ionized gases; Rovinj, Yugoslavia (16 Sep 1974).

In seventh Yugoslav symposium on physics of ionized gases.

Studies of multiple-scattering distributions of 500-keV ions transmitted through thin solid films are described. Results are shown for targets of C, Se, Pd, Ag, Te, Au, Au + C, Bi, and Ta_2O_5. The experimental data are compared with theory. (3 figs.) (GHT)

7395 (CONF-740985-, pp 99-101) MEASUREMENTS ON THE TRANSMISSION SPUTTERING YIELD OF POLYCRYSTALLINE GOLD FOILS FOR HEAVY-ION BOMBARDMENT. Bay, H. L.; Andersen, H. H.; Hofer, W. O. (Univ. of Aarhus, Denmark). 1974.

From 7th symposium on physics of ionized gases; Rovinj, Yugoslavia (16 Sep 1974).

In seventh Yugoslav symposium on physics of ionized gases.

Rutherford scattering technique was used to determine sputtering yields of gold foils bombarded by argon ions. Yields were measured by comparing initial count rate of a transmitted beam to the final count rate after sputtering. Thin coverings of aluminum or carbon were used to prevent backsputtering while transmission sputtering was measured. Results are shown. (3 figs., 9 refs.) (GHT)

7396 (CONF-740985-, pp 113-116) ARGON AUGER EMISSION BY Ar^+ ION BOMBARDMENT OF METALS. Viaris de Lesegno, P.; Hennequin, J. F. (CNRS, Saint-Denis, France). 1974.

From 7th symposium on physics of ionized gases; Rovinj, Yugoslavia (16 Sep 1974).

In seventh Yugoslav symposium on physics of ionized gases.

The conditions for argon Auger emission during argon ion bombardment of some metals are discussed. The argon Auger spectrum resulting from bombardment of a titanium target with 14-keV argon ions is shown. The experimental results are stated. (4 figs.) (GHT)

7397 (CONF-740985-, pp 117-120) ELECTRONIC STOPPING OF LOW ENERGY He^+ IONS REFLECTED FROM A (100)-FACE OF A COPPER SINGLE CRYSTAL. Verhey, L. K.; Poelsema, B.; Boers, A. L. (State Univ., Groningen, Netherlands). 1974.

From 7th symposium on physics of ionized gases; Rovinj, Yugoslavia (16 Sep 1974).

In seventh Yugoslav symposium on physics of ionized gases.

The scattering of 4-10 keV He^+ ions is observed at a fixed scattering angle of 30° with a varied angle of incidence. The relationship between the most probable relative energy E/E_0 of scattered ions and the angle of incidence is shown for 10-keV He^+ ions. Energy dependence of the inelastic energy loss is also shown. (2 figs, 16 refs) (GHT)

7398 (CONF-740985-, pp 125-130) ENERGY AND ANGULAR DISTRIBUTIONS OF LOW ENERGY NOBLE GAS IONS SCATTERED FROM Cu(110). de Wit, A. G. J.; v.d. Schootbrugge, G. A.; Fluit, J. M. (Univ. of Utrecht). 1974.

From 7th symposium on physics of ionized gases; Rovinj, Yugoslavia (16 Sep 1974).

In seventh Yugoslav symposium on physics of ionized gases.

Experiments with 1-keV Ne^+ ions bombarding a Cu(110) single crystal in a (111) plane are described. The interatomic potential between the noble gas ion and metal atom was calculated and the minimum angle for multiple scattering determined for various angles of incidence. (6 figs., 17 refs.) (GHT)

7399 (CONF-740985-, pp 131-134) ENERGY DISTRIBUTION AND MEAN ENERGY OF SECONDARY IONS OBTAINED BY SPUTTERING OF SURFACE IMPURITIES. Jurela, Z. (Boris Kidric Inst. of Nuclear Sciences, Belgrade). 1974.

From 7th symposium on physics of ionized gases; Rovinj, Yugoslavia (16 Sep 1974).

In seventh Yugoslav symposium on physics of ionized gases.

The energy distribution of sputtered surface impurity ions from a variety of targets was studied. Results are shown for CH^-, C_2^-, C_2H^-, MgO^+, CoO^+, and TaO^+ ions sputtered from targets of C, Mg, Al, Co, Cu, Au, Ni, Ge, and Ta. (7 figs.) (GHT)

7400 (CONF-740985-, pp 159-162) PRELIMINARY RESULTS OF A MACROSCOPIC METHOD OF INVESTIGATING OBLIQUE ANGLE SPUTTERING OF DIELECTRICS. Meckel, B.; Kraljevic, N.; Adamov, M.; Nenadovic, T. (Boris Kidric Inst. of Nuclear Sciences, Belgrade). 1974.

From 7th symposium on physics of ionized gases; Rovinj, Yugoslavia (16 Sep 1974).

In seventh Yugoslav symposium on physics of ionized gases.

A macroscopic technique is described wherein fibers of 20 to 140 micron diameter are bombarded by argon ions travelling perpendicular to the fiber axis. The resulting fiber cross sections are observed to determine the optimum sputtering angle. Results are shown for SiO_2 fibers bombarded by 3, 6, and 12 keV argon ions. The experimental method is discussed. (4 figs.) (GHT)

7401 (COO-2326-9) HIGH-INTENSITY SUPERTHERMAL SOURCE OF HYDROGEN ATOMS. Way, K. R.; Yang, S. C.; Stwalley, W. C. (Iowa Univ., Iowa City (USA). Dept. of Chemistry). 1975. 4p. (CONF-750705-2). Dep. NTIS $4.00.

From 9th international conference on physics of electronic and atomic collisions; Seattle, Washington, USA (24 Jul 1975).

A high intensity source of superthermal hydrogen atoms for molecular beam studies is described. The minimum source temperature seems to be at least 4000°K. Fluxes on the order of 10^{15} atoms/cm^2/sec at 1 meter were obtained for periods of 12 hours. (JFP)

7402 (ISN-TS-74-5) DEVELOPMENT OF A ^{6}Li AND ^{10}B MULTICHARGED ION SOURCE. Bouchaib, P. (Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires; Grenoble-1 Univ., 38 (France)). 1974. 92p. (In French). INIS.

A reflex gauge (P. I. G.) with heated cathode is realized to produce positive multicharged ions of solid compounds (i.e., lithium). The use of boron trichloride (BCl_3) as neutral gas is acceptable if the corrosion of the metals of the source by the chloride gas is avoided. The use of hafnium carbide as cathode material decreases the sputtering rate by a factor 3 to 10 and increases the life of the gauge by the same factor. Measurements by Langmuir probe method of electronic temperature and density of positive ions in the plasma of the source versus voltage intensity of the arc and magnetic field give an idea of its configuration in the anode. (FR)

7403 INVESTIGATION OF RF SPUTTER ETCHED SILICON SURFACES USING HELIUM ION BACKSCATTER. Sachse, G. W.; Miller, W. E.; Gross, C. (National Aeronautics and Space Administration, Langley Station, VA). Solid-State Electron.; 18: No. 5, 431-435(May 1975).

The effect of RF sputter etching on the (111) surface of silicon was studied by observing backscatter spectra from a 2 MeV, $^4He^+$ beam oriented along the silicon ⟨111⟩ channel. Silicon samples were RF sputter etched in a 5×10^{-3} torr, argon discharge at electrode bias potentials ranging from 0.5 to 2.5 kV. The samples were sputter etched for a time sufficient for the lattice damage to reach saturation. Analysis of these samples revealed that the thickness of this damage layer and the concentration of trapped argon increased with electrode bias potential. An annealing study of these damaged surfaces was carried out to 900°C. (auth)

7404 DEFINITION OF THE FORM OF PLASMA EMITTER AND ACCELERATED BEAM IN AN ION-OPTICAL SYSTEM. Boldasov, V. S.; Volkov, B. I.; Sveshnikov, A. G.; Semashko, N. N. (Moscow State Univ.). Dokl. Akad. Nauk SSSR; 218: No. 5, 1049-1051(11 Oct 1974). (In Russian).

Equations defining the form of the plasma emitter and accelerated beam in an ion-optical system are derived. Numerical solution of the equations show that an increase of the relative dimensions of the plasma emitter leads to a decrease of the optimal angle of dispersion. (JSR)

7405 ASSIGNMENT OF ION CURRENTS DETECTED IN THE MASS SPECTRUM OF A MOLECULAR BEAM. Farrow, R. F. C. (Royal Radar Establishment, Malvern, Eng.). J. Phys., D (London); 8: No. 4, L48-L52(11 Mar 1975).

A technique for assigning ion currents detected in the mass spectra of molecular beams is described with reference to the particular case of a molecular beam generated from a Knudsen effusion oven containing InP. Areas where the technique would find application are suggested. (auth)

7406 MEDIUM-ENERGY ION SCATTERING BY SOLID SURFACES. Mashkova, E. S.; Molchanov, V. A. (Moscow State Univ.). Radiat. Eff.; 23: No. 4, 215-270(1974).

A review is presented under the following headings—early work; scattering regularities in the primary ion incidence plane and double scattering effect (dependence on primary ion energy; angular dependences; dependence on scattering angle; dependence on sliding angle; dependence on azimuthal angle of target rotation; target temperature dependence; dependence on other parameters; different crystals; different ions; different charge states of scattered ions; dependence on irradiation dose); spatial regularities of medium energy in scattering by crystals (experimental work); theoretical treatment of ion scattering by crystal surfaces (three-dimensional scattering model; two-atomic model; "isolated atomic row" model; other models); comparisons with experiment (explanation of the basic directional effects in medium energy ion scattering by crystals; qualitative interpretation of regularities of ion scattering by crystal surfaces). (91 references) (auth)

7407 THEORY OF THE PRODUCTION OF INTENSE ION BEAMS IN THE RELATIVISTIC DIODE. Wheeler, C. B. (Imperial Coll. of Science and Tech., London). J. Phys., D (London); 8: No. 2, 117-126(1 Feb 1975).

Ions are considered to be generated within the diode either by laser ablation of the anode surface or through electron-neutral collisions taking place in front of the anode. Calculations are carried out for anode potentials up to 10 MV, and it is shown that the allowed ion currents can be several multiples of the Child-Langmuir limit. For both techniques of ion generation the optimum electron current required for space-charge neutralization can be readily produced by field emission, since the cathode electric field can exceed the space-charge-free value. (auth)

7408 DESIGN AND OPERATING CHARACTERISTICS OF A LOW PRESSURE ION SOURCE. Fitch, R. K.; Chander, A. M.; Rushton, G. J.; Singh, R. (Univ. of Aston, Birmingham, Eng.). Jap. J. Appl. Phys.; No. Suppl. 2, 411-414(1974).

From 6th international vacuum congress; Kyoto, Japan (25 Mar 1974). See CONF-740353-.

The operating characteristics of various designs of the twin anode electrostatic ion source are described. The ion extraction system was modified to improve the efficiency of the source and increase the ion beam intensity. A water cooled source was produced which is very stable and was used continuously for many hours without any deterioration in performance. A thermionic version of the source was also constructed which should be suitable for ultra high vacuum and produces ions of average energy of several 100 eV. Scanning electron micrographs of a cadmium sulphide field-ion emitter tip which was ion sharpened with this source are given to illustrate one of its important applications. (auth)

7409 BEAM-PLASMA TYPE ION SOURCE FOR HIGH-INTENSITY ION BEAM AND ITS APPLICATION TO SURFACE MICROANALYZER. Takagi, T. (Kyoto Univ.); Yamada, I.; Ishikawa, J.; Sano, F.; Kishi, T. Jap. J. Appl. Phys.; No. Suppl. 2, 423-426(1974).

From 6th international vacuum congress; Kyoto, Japan (25 Mar 1974). See CONF-740353-.

The gas in the drift tube is ionized by the microwave (2 to 10 GHz) power induced by the beam-plasma interactions since a magnetically focused electron beam injected into a drift tube from an ion extractor interacts strongly with the plasma. Therefore, a high density plasma is effectively generated in the drift tube by the beam-plasma discharge. A well confined and high intensity ion beam can be extracted because of the neutralization of the injected beam near the extractor. When the extracted ion current increases, the high density plasma then generated is stable in density because of a feedback phenomenon in which the beam-plasma interactions keep the plasma density constant. Some dynamic characteristics are reported. As a special application, a new type of ion micro-analyzer with an electron beam guiding function by using the ion source of a similar structure is proposed. (auth)

7410 AUGER EMISSION FROM ARGON DURING THE BOMBARDMENT OF VARIOUS METALS BY A^+ IONS. Viaris de Lesegno, P.; Hennequin, J. F. (Centre National de la Recherche Scientifique, 93 - Saint-Denis (France). Lab. des Proprietes Mecaniques et Thermodynamiques des Materiaux). J. Phys. (Paris).; 35: No. 10, 759-771(Oct 1974). (In French).

The conditions for Auger electron emission from argon during ion bombardment of solid targets by Ar^+ ions are studied for the case of metals (K, Ca, Sc, Ti, V, Cr) bombarded by Ar^+ ions at energies lower than 15 keV. The Ar^+ ion energy must exceed a threshold value which depends on the target and is of the order of 10 keV for the metals studied. Analogous to gaseous collisions, the results indicate that electronic transitions are effective at crossings of the molecular orbitals created during the collision. (FR)

7411 SEM INVESTIGATION OF IRON SURFACE ION EROSION AS A FUNCTION OF SPECIMEN TEMPERATURE AND INCIDENCE ANGLE. Vasiliu, F.; Teodorescu, I. A.; Glodeanu, F. (Institutul de Fizica Atomica, Bucharest). J. Mater. Sci.; 10: No. 3, 399-405(Mar 1975).

Ion bombardment of iron surfaces produced an ion eroded surface microtopography strongly dependent on the incidence angle and specimen temperature. For bombardment temperatures exceeding the self-diffusion temperature, T_d, a microstructural smoothing process due to the thermally activated diffusion effects, assisted by ion bombardment, can be observed by SEM. The role of migrational processes which should be taken into account for a correct interpretation of the final surface topography formed by "hot sputtering," was also considered. (auth)

7412 MOMENTUM DEPOSITION BY HEAVY-ION BOMBARDMENT AND AN APPLICATION TO SPUTTERING. Littmark, U.; Sigmund, P. (Univ. of Copenhagen, Denmark). J. Phys., D (London); 8: No. 3, 241-245(21 Feb 1975).

The depth distribution of momentum deposited by heavy-ion bombardment of random targets was calculated. A brief report is given on the transport equation governing deposited momentum and its solution via moment expansion, as well as the problem of constructing the momentum profiles from given moments. Two representative examples are shown, and from the results the mean velocities of sputtered atoms were calculated. These are compared with experimental data from the literature. Momentum distributions are relevant to recoil implantation. (auth)

Atomic and Molecular Properties

Refer also to abstracts 7112, 7123, 7454, and 7928.

7413 (AD/A-001916) RELATIVE TRANSITION PROBABILITIES IN DE-EXCITATION OF ATOMIC STATES BY COLLISIONAL QUENCHING. Franz, F. A.; Boggy, R.; Sooriamoorthi, C. E. (Indiana Univ., Bloomington (USA). Dept. of Physics). 1974. 4p. (AFOSR-TR-74-1815). NTIS $3.25.

Relative probabilities were measured for quenching induced transitions between the Zeeman sublevels of the doublet $P(^1/_2)$ and doublet $S(^1/_2)$ states of cesium. (auth)

7414 (N-74-32179) RESEARCH ON THE PROPERTIES AND INTERACTIONS OF SIMPLE ATOMIC AND IONIC SYSTEMS. Final Report, 1 January 1963–31 December 1972. Novick, R. (Columbia Univ., New York (USA)). 31 Dec 1972. 22p. (NASA-CR-139666; CAL-1263). NTIS $4.25.

Simple ionic systems were studied, such as metastable autoionizing states of the negative He ion, two-photon decay spectrum of metastable He ion, optical excitation with low energy ions, and lifetime measurements of singly ionized Li and metastable He ion. Simple atomic systems were also investigated. Metastable autoionizing atomic energy levels in alkali elements were included, along with lifetime measurements of Cr-53, group 2A isotopes, and alkali metal atoms using level crossing and optical double resonance spectroscopy. (STAR)

7415 TOTAL ABSORPTION COEFFICIENT OF THE NEGATIVE HYDROGEN ION. Bell, K. L.; Kingston, A. E.; McIlveen, W. A. (Queen's Univ., Belfast). J. Phys., B (London); 8: No. 3, 358-364(21 Feb 1975).

The free-free absorption coefficient of the negative hydrogen ion is calculated in both the length and velocity formulations using the method of polarized orbitals to describe the free electron. The bound-free cross section of Bell and Kingston (Proc. Phys. Soc.; 90: 895-899(1967)) is converted to an absorption coefficient and combined with the present free-free results. Comparison with other calculations and the use of certain oscillator strength sum rules suggests that the total H^- absorption coefficient values are accurate to better than 10%. (auth)

7416 EXPERIMENTAL STUDY ON THE $(\mu^4He)^+_{2S}$ METASTABLE SYSTEM IN HELIUM GAS. Bertin, A. (CERN, Geneva); Carboni, G.; Placci, A. Nuovo Cim., B; 26B: No. 2, 433-480 (11 Apr 1975).

The results of an experimental investigation on the properties of the $(\mu He)^+_{2S}$ metastable muonic system are reported, which was performed stopping negative muons in a pure helium target at pressures ranging from 10 to 50 atm, and observing the total yield and the differential time distribution of the x-rays released in delayed coincidence with the arrival of muons. At each pressure P, information was obtained on the following quantities: the total disappearance rate $\lambda_{2S,\,tot}(P)$ of the $(\mu He)^+_{2S}$ system, the disappearance rates $\lambda_A(P)$ and $\lambda_{St}(P)$ of the $(\mu He)^+_{2S}$ system for external Auger effect and Stark-mixing collisions, the fraction $\epsilon_{2S}(P)$ of muons stopped in helium which form the $(\mu He)^+_{2S}$ system. The results obtained on $\epsilon_{2S}(P)$ are in agreement with the results of a cascade calculation, which was performed requiring consistency with previous experimental results; the present measurements show that the variation of $\epsilon_{2S}(P)$ with pressure in the range (7 ÷ 50) atm is small. Good agreement was found between the values for the two-quantum decay rate $\lambda_{2\gamma}$ of the $(\mu He)^+_{2S}$ system derived from the present data and the theoretical predictions. The results obtained on $\lambda_{2S,\,tot}(P)$, instead, are somewhat in conflict with the results of a recent calculation on $\lambda_{St}(P)$. The possible reasons of such disagreement are discussed, referring to possible clustering effects of the helium atoms around the $(\gamma He)^+$ ion. (auth)

7417 FREE– FREE ABSORPTION COEFFICIENT OF THE NEGATIVE ION OF MOLECULAR HYDROGEN. Bell, K. L.; Kingston, A. E.; McIlveen, W. A. (Queen's Univ., Belfast). J. Phys., B (London); 8: No. 4, 659-664(11 Mar 1975).

The free-free absorption coefficient of the negative ion of molecular hydrogen is calculated in the dipole length formulation using wave functions which take account of exchange and polarization effects on the free electron. The results are found to be approximately one half of those for H^-. (auth)

7418 DISPLACEMENTS OF ELECTRON EJECTION ENERGIES IN NEAR-THRESHOLD EXCITATION OF AUTOIONIZING LEVELS OF HELIUM BY ELECTRON IMPACT. Hicks, P. J.; Cvejanovic, S.; Comer, J.; Read, F. H.; Sharp, J. M. (Univ. of Manchester, Eng.). Vacuum; 24: No. 11/12, 573-580 (Dec 1974).

From conference on negative ions; Liverpool, Eng. (17 Apr 1974).

The four lowest autoionizing levels in helium, namely $(2s^2)^1S$, $(2s2p)^3P$, $(2p^2)^1D$, and $(2s2p)^1P$, were studied near their thresholds for excitation by electron impact. Features in the spectra of electrons ejected from these states were seen to shift to steadily higher energies as the impact energy was lowered to within a few electron volts above threshold. This phenomenon is compared with a similar one which was observed in the scattering of low energy helium ions from helium atoms. A qualitative explanation of these observations can be provided by considering a "post-collision interaction" between the scattered particle and the ejected electron. The limitations of this model are discussed. Structure in the spectra suggest that the situation is complicated by an interference phenomenon which cannot be explained in a classical treatment of the problem. The threshold electron excitation spectrum of these autoionizing levels was also obtained, using an apparatus designed to detect very low energy electrons. As well as confirming the observations described above, this revealed the presence of one of the two negative ion states known to exist in this region. In an effort to obtain a complete picture of the processes taking place in helium at these energies, the negative ion states were also studied in direct ionization and in elastic scattering at various angles. The latter measurements confirmed the classifications of these states as $(2s^22p)^3P$ and $(2s2p^2)^3D$, and values were obtained for their energies of 57.22 ± 0.04 eV and 58.30 ± 0.04 eV respectively. (auth)

7419 CONTRIBUTION OF ION PERTURBERS TO THE FAR WINGS OF LYMAN-. Rang, L. O.; Voslamber, D. (Univ., Paris). J. Phys., B (London); 8: No. 2, 331-336(1 Feb 1975).

The contribution of proton perturbers to the far wings of the Lyman-α line of hydrogen is calculated in the adiabatic one-perturber limit. The wing expression is evaluated using the electronic molecular eigenstates of H_2^+. (auth)

7420 HYPERSPHERICAL FORMALISM APPLIED TO He-LIKE ATOMS. Ballot, J. L.; Navarro, J. (Paris Univ., Orsay, France). J. Phys., B (London); 8: No. 2, 172-178(1 Feb 1975).

The convergence of the binding energy for the He-like atoms in the framework of the hyperspherical formalism is analyzed. The calculations give for the helium ground state a binding energy of –2.903 au. (auth)

7421 COHERENTLY EXCITED ATOMS IN EXTERNAL ELECTRIC FIELDS. Lombardi, M. (Univ., Grenoble, France); Giroud, M.; Macek, J. (Univ., Grenoble, France). Phys. Rev., A.; 11: No. 3, 1114-1117(Mar 1975).

Various manifestations of coherent mixtures of even- and odd-parity eigenstates of collision-excited atomic hydrogen in external electric fields are discussed on general grounds. It is shown that when even- and odd-parity states are coherently excited, application of an electric field perpendicular to the velocity axis induces orientation in the originally unoriented atoms. Circular polarization of the decay radiation is an observable consequence of the orientation. (auth)

7422 IONIZATION OF HIGHLY EXCITED HYDROGEN ATOMS BY INTENSE ELECTROMAGNETIC FIELDS. Gersten, J.; Mittleman, M. H. (City Coll., New York). Phys. Rev., A.; 11: No. 3, 1103-1104(Mar 1975).

A previous theory of atomic transitions in ultrastrong electromagnetic fields is applied to the problem of the ionization of highly excited hydrogen atoms. The magnitude of the fields necessary for the validity of the theory is greatly reduced by using excited hydrogen in the initial state, and the requirement of only multiphoton ionization limits the application to low frequency (microwave) fields. The requirement can probably be satisfied with currently available equipment. A result of the calculation is that the average number of photons absorbed is twice the minimum number. (auth)

7423 VARIATIONAL PRINCIPLES FOR THE DETERMINATION OF SINGLE-PARTICLE DENSITY MATRICES. Sahni, V.; Krieger, J. B. (City Univ. of New York, Brooklyn). Phys. Rev., A; 11: No. 2, 409-417(Feb 1975).

A variational formalism for the determination of the spinless single-particle density matrix gamma($\vec{r},\vec{r}'$) for an interacting many-particle system, correct to second order, is developed. The method is based on variational principles for determining single-particle expectation values, correct to second order, without requiring highly accurate wave functions in order to represent the interacting system. The expectation value of the operator X equals Y + lZ, where Y equals (½) SIGMA/sub j/[W($\vec{r}$/sub j/) T/sub j/($\vec{a}$) + W($\vec{r}$/sub j/′sup ,/) T/sub j/(−$\vec{a}$)], Z equals −(l/2) SIGMA/sub j/ [W($\vec{r}$/sub j/) T/sub j/($\vec{a}$) − W($\vec{r}$/sub j/′sup ,/) T/sub j/(−$\vec{a}$)], W($\vec{r}$/sub j/) equals delta($\vec{r}$/sub j/ − $\vec{r}$), T/sub j/($\vec{a}$) is a translation operator, and $\vec{a}$ equals $\vec{r}$/sup ,/ − $\vec{r}$, is the reduced single particle density matrix. For a given choice of a Slater-determinant-type trial wave function it is shown that the density matrix may be obtained from the charge density of the system where the latter too is determined via the same formalism to second order as the expectation value of the operator W employing the same system trial wave function. The applicability of the technique is then demonstrated by showing that for the model hydrogen-atom problem it leads to highly accurate results for the momentum density and the Compton profile in the impulse approximation, and that the virial theorem is closely satisfied, even when the calculations of the various properties employing an approximate trial wave function alone are substantially in error. (auth)

7424 RELAXATION OF THE HYPERFINE STRUCTURE LEVELS IN HYDROGEN ATOMS IN THE FUNDAMENTAL STATE. Desaintfuscien, M.; Audoin, C. (Centre National de la Recherche Scientifique, 91 - Orsay (France). Lab. de l'Horloge Atomique). J. Phys. (Paris).; 35: No. 11, 829-838(Nov 1974). (In French).

A population modulation method which allows a precise measurement of longitudinal and transversal relaxation times of atomic hydrogen in a hydrogen maser is described. The escape rate of atoms from the bulb can also be measured. Relaxation rate of the hydrogen atoms due to wall collisions is deduced from the results. The effects of magnetic relaxation are analyzed in detail and an experimental test is established which allows to determine whether or not the magnetic coupling between the Zeeman states is sufficient to impair the validity of the measurements. In the case of the hydrogen maser the hydrogen density dependent wall relaxation is shown to be negligible at 295 K and the correlation time for the magnetic interaction of the hydrogen atoms on the teflon wall is shorter than 10^{-11}s. (FR)

7425 FREE−FREE TRANSITIONS OF ATOMIC AND MOLECULAR NEGATIVE IONS IN THE INFRARED. John, T. L. (University Coll. of South Wales and Monmouthshire, Cardiff, Eng.). Mon. Notic. Roy. Astron. Soc.; 170: No. 1, 5-6(Jan 1975).

The free-free absorption coefficient of the negative ions He^-, Ne^-, Ar^-, Kr^-, Xe^-, Li^-, Na^-, Cs^-, Hg^-, N^-, O^-, H_2^-, N_2^-, O_2^-, CO^-, CO_2^- and H_2O^- is given in the temperature range 50 to 25,000 K. Calculations are based on theoretical and experimental momentum loss cross section data. (auth)

7426 TERM ANALYSIS OF Y V. Zahid-Ali; Chaghtai, M. S. Z.; Singh, S. P. (Aligarh Muslim Univ., India). J. Phys., B (London); 8: No. 2, 185-193(1 Feb 1975).

Yttrium spectrum was recorded on the 5 m grazing incidence spectrograph at Lund (Sweden) from about 130 to 440 Å. Transitions from 5d, 6d, 6s and 7s to the ground levels of Y V are identified for the first time; those from 4d and 5s levels, reported earlier, were confirmed. The fifth ionization potential of yttrium, $4p^6\ ^1P_1$-$4p^4\ ^3P_2$, is evaluated from the straight nJ and nd Rydberg series as (6.047 ± 0.025) × 10^5 cm^{-1}. The ionization potential for Sr IV is estimated to be 4.462 × 10^5 cm^{-1} from the isoelectronic comparison of the ionization potentials of Br I sequence. The parameters G_1 and ζ_p are calculated for ^3P and ^4P levels of 5s and 6s. (auth)

Positronium, Muonium, and Muonic and Mesic Atoms and Molecules

Refer also to abstract 7570.

7427 (CEA-R-4659) EXPERIMENTAL INVESTIGATION BY POSITRON ANNIHILATION OF ELECTRON MOMENTUM DISTRIBUTIONS IN MAGNESIUM OXIDE AND SILICIUM AND COMPARISON WITH COMPTON SCATTERING. Haulbert, A. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Apr 1975. 122p. (In French). Dep. NTIS (US Sales Only) $9.25.

Thesis. Submitted to Paris Univ.

The linear momentum distribution of electrons as measured by the angular correlation of annihilation quanta in magnesium oxide and silicium monocrystals are compared with experimental valence Compton profiles. These comparisons show that over the first Brillouin zone for MgO and over the Jones zone for Si, the positron, which mainly annihilates with valence electrons, does not disturb electron momentum distributions much. On the other hand, despite the incertainties on tails of valence Compton profiles, as are verified in MgO, the annihilation probability of positron beyond these limits is clearly dehanced. In Si, a correct normalization of angular correlation curves from lifetime measurements indicates a decrease of the momentum density enhancement by a factor 3 beyond the zone boundary. (auth)

7428 (CONF-7306115-P1, pp C.IX0-C.IX13) $\alpha^2 ln\alpha^{-2}$ AND HIGHER-ORDER CORRECTIONS TO THE POSITRONIUM HYPERFINE STRUCTURE. Owen, D. A. (CNRS, Marseille). 1973.

From 3rd international colloquium on advanced computing methods in theoretical physics; Marseille, France (25 Jun 1973).

In third international colloquium on advanced computing methods in theoretical physics, Marseille, June−29, 1973. (Centre National de la Recherche Scientifique, 13 - Marseille (France). Centre de Physique Theorique).

The present status of positronium theory is discussed including problems related to the yet uncalculated higher-order corrections (i.e., α^2 corrections) to the positronium hyperfine structure. (JFP)

7429 (CONF-7306115-P1, pp C.X1-C.X12) INFRARED DIVERGENCES AND NONANALYTICITY IN α: AN EXAMPLE IN POSITRONIUM. Barbieri, R. (Univ. of Maryland, College Park). 1973.

From 3rd international colloquium on advanced computing methods in theoretical physics; Marseille, France (25 Jun 1973).

In third international colloquium on advanced computing methods in theoretical physics, Marseille, June 25−29, 1973. (Centre National de la Recherche Scientifique, 13 - Marseille (France). Centre de Physique Theorique).

A specific contribution to the hyperfine splitting is considered, namely that coming from the vacuum polarization corrections to the one photon annihilation process. (JFP)

7430 (COO-3373-18) POSITRONIUM CHEMISTRY. Final Report, February 1966−January 1975. Tao, S. J. (New England Inst., Inc., Ridgefield, Conn. (USA)). 1975. Contract AT(11-1)-3373. 39p. Dep. NTIS $5.00.

Experimental research on positronium is summarized. A list of publications is included. A list of publications is included. (JFP)

7431 EXPERIMENTAL INVESTIGATIONS OF FREE MU-NUCLEON ATOMS. Varlamov, V. G.; Dobretsov, Yu. P.; Dolgoshein, B. A.; Kirillov-Ugryumov, V. G.; Nevskii, P. L.; Rogozhin, A. M.; Smilga, V. P. (Moscow Engineering-Physics Inst.). Yadern. Fiz.; 21: No. 1, 120-132(Jan 1975). (In Russian).

Properties of mu-nucleon atoms, i.e. muonic atoms with filled electronic shell, are described. Experimental data proving the existence of free mu-nucleon atom of fluorine are presented. Possible use of the mu-nucleon atoms to study the physico-chemical properties of the matter is discussed. (5 figures, 3 tables) (auth)

7432 MUONIUM. Firsov, V. G. (Inst. for Theoretical and Experimental Physics, Moscow); Goldanskii, V. I. pp 1-47 of Radiochemistry. Maddock, A. G. (ed.). London; Butterworths (1975).

The subject is reviewed in chapters entitled: nuclear physical characteristics of the μ^+-meson and muonium; the physicochemical basis of muonium interactions; observation and investigation of triplet atomic muonium; determination of absolute rate constants for chemical reactions involving muonium; temperature dependence of the rates of muonium reactions; reactions of muonium with aromatic unsaturated compounds. (UK)

Collision Phenomena

Refer also to abstracts 6589 and 7418.

7433 (AD/A-002250) MULTIPLY CHARGED IONS, EXCITATION, AND IONIZATION BY ELECTRON IMPACT. Final Report, 1 December 1970−31 October 1974. Sharp, T. E.; Mass, B.; Bradbury, R. N. (Lockheed Missiles and Space Co.,

Palo Alto, Calif. (USA). Lockheed Palo Alto Research Lab.). 10 Dec 1974. 46p. NTIS $3.75.

A crossed-beam study of the electron impact excitation and ionization of N^{+4} is described. A beam of N^{+4} ions with MeV energy is produced in a van de Graaff accelerator coupled with a gas stripper and separated from other charge states by magnetic and electrostatic analysis. The ion beam is crossed with a variable energy electron beam in a well defined geometry. Radiation from the excited ions is observed with a photomultiplier downstream from the interaction region. The ions promoted to higher charge states are separated from the primary beam electrostatically and detected with a silicon surface-barrier detector. Chopping of both ion and electron beams is employed. Results are presented for the N^{+4} transition at 1240 A in the collision energy range 130 to 400 eV. Substantial reduction in the N^{+3} background was achieved but variations in this background precluded measurement of the ionization cross section of N^{+4}. (auth)

7434 (AED-CONF-74-306-012) THE QUASI-MOLECULAR MODEL OF ATOMIC COLLISIONS. Lichten, W. (Yale Univ., New Haven, Conn. (USA). Dept. of Physics). 1974. 37p. INIS.

From 4th international conference on atomic physics; Heidelberg, F. R. Germany (22 Jul 1974).

A review is given of the following topics: 1) Molecular states for one- and many-electron molecules, especially diabatic states, 2) extension of these concepts to collisions of complex atoms with a shell structure by means of the electron promotion model (Fano–Lichten model) and the application to inner shell excitation by heavy particles, 3) production and properties of molecular X-rays in atomic collisions, 4) mechanism of vacancy production in collisions between heavy atoms, 5) relativistic effects; superheavy atoms; positron formation in atomic collisions. (GE)

7435 (CONF-740985-) SEVENTH YUGOSLAV SYMPOSIUM ON PHYSICS OF IONIZED GASES, 16–21 SEPTEMBER 1974, Rovinj, Yugoslavia. (Zagreb Univ. (Yugoslavia)). 1974. 404p.

From 7th symposium on physics of ionized gases; Rovinj, Yugoslavia (16 Sep 1974).

Separate abstracts are prepared for 27 of the 96 papers included. The remaining papers were not within the NSA subject scope. (CES)

For abstracts of individual papers see: 7282, 7392–7400, 7436–7451, and 7868.

7436 (CONF-740985-, pp 3-6) LOW ENERGY ELASTIC SCATTERING OF ELECTRONS BY HELIUM ATOM. Amusia, M. Ya. (Ioffe Inst. of Physics and Tech., Leningrad); Cherepkov, N. A.; Shapiro, S. G.; Tancic, A. R. 1974.

From 7th symposium on physics of ionized gases; Rovinj, Yugoslavia (16 Sep 1974).

In seventh Yugoslav symposium on physics of ionized gases.

The total and differential cross sections for elastic scattering of slow electrons by helium atoms are calculated with many electron correlations included by the random phase approximation with exchange. Effects of electron correlations are included in the self-energy part of the single particle Green's function, or optical potential. Results are compared with previous calculations and with experiments. Good agreement is obtained. (3 figures) (GHT)

7437 (CONF-740985-, pp 7-9) TESTING OF CLASSICAL AND QUANTUM MECHANICAL CRITERIA TO ELASTIC SCATTERING OF ELECTRONS BY NOBLE GASES. van Wingerden, B.; de Heer, F. J.; Jansen, R. H. J.; Los, J. (FOM-Instituut voor Atoom-en Molecuulfysica, Amsterdam). 1974.

From 7th symposium on physics of ionized gases; Rovinj, Yugoslavia (16 Sep 1974).

In seventh Yugoslav symposium on physics of ionized gases.

A classical model of the scattering of particles by a center of force using an inverse power potential is applied in the energy region where the Born approximation is not valid. The classical analysis agrees with earlier experimental data from He, Ne, and Ar at 100-3000 eV. (3 figures) (GHT)

7438 (CONF-740985-, pp 11-14) SPIN POLARIZATION OF ELECTRONS ELASTICALLY SCATTERED FROM XENON ATOMS. Kessler, J.; Lucas, C. B.; Vuskovic, L. (Univ., Muenster, Ger.). 1974.

From 7th symposium on physics of ionized gases; Rovinj, Yugoslavia (16 Sep 1974).

In seventh Yugoslav symposium on physics of ionized gases.

Measurement of spin polarization of electrons (150 to 1200 eV) elastically scattered from xenon atoms is described, along with description of the experimental apparatus. Comparison is made to earlier studies of scattering from Hg atoms and with non-exchange calculations showing improved agreement toward higher electron energies. The importance of exchange at 200 eV and 300 eV is pointed out. (GHT)

7439 (CONF-740985-, pp 15-18) APPLICABILITY OF THE GEOMETRIC FACTOR "SIN" APPROXIMATION IN SCATTERING EXPERIMENTS. Kalezic, S.; Vuskovic, L.; Kurepa, M. (Inst. of Physics, Belgrade). 1974.

From 7th symposium on physics of ionized gases; Rovinj, Yugoslavia (16 Sep 1974).

In seventh Yugoslav symposium on physics of ionized gases.

An alternate method is given for calculating the "geometric factor" for particle scattering from a gaseous target. This method is used to verify that the error in the commonly used "sin" approximation is of the order of 0.5% for scattering angles of 5° and 175° and decreases toward 0% for angles between 5° and 175°. (2 figures) (GHT)

7440 (CONF-740985-, pp 19-22) DIFFERENTIAL CROSS SECTIONS OF 200 AND 300 eV ENERGY ELECTRONS ELASTICALLY SCATTERED BY KRYPTON ATOMS. Vuskovic, L.; Kurepa, M.; Bocvarski, V. (Inst. of Physics, Belgrade). 1974.

From 7th symposium on physics of ionized gases; Rovinj, Yugoslavia (16 Sep 1974).

In seventh Yugoslav symposium on physics of ionized gases.

Differential cross section data are presented for scattering angles of 10° to 25°. The narrow angular interval was selected to maximize the scattered electron signal. Resulting cross section curves are compared with calculated curves and other experimental measurements. (2 figures) (GHT)

7441 (CONF-740985-, pp 23-25) RESONANT ELECTRON IMPACT EXCITATION OF THE SYMMETRIC STRETCH VIBRATIONAL LEVELS OF CO_2. Cadez, I. (Inst. of Physics, Belgrade). 1974.

From 7th symposium on physics of ionized gases; Rovinj, Yugoslavia (16 Sep 1974).

In seventh Yugoslav symposium on physics of ionized gases.

A one-dimensional model is used to calculate the symmetric stretch vibrational excitation of CO_2. Experimental data are compared with calculated values showing good agreement for the lower vibrational states. (2 figures) (GHT)

7442 (CONF-740985-, pp 31-34) HIGH RESOLUTION STUDIES OF SOME ELECTRON EXCITATION AND POLARIZATION FUNCTIONS IN HELIUM. Kurepa, J. M. (Inst. of Physics, Belgrade); Heddle, D. W. O.; Keesing, R. K. 1974.

From 7th symposium on physics of ionized gases; Rovinj, Yugoslavia (16 Sep 1974).

In seventh Yugoslav symposium on physics of ionized gases.

Excitation functions are presented for transitions 5^3S–2^3P, 5^1S–2^1P, and 6^1S–2^1P in helium. Energies for the transitions are given. A curve showing the polarization function measurement in the 3^3P–2^3S transition is compared with the excitation function of this transition. (2 figures) (GHT)

7443 (CONF-740985-, pp 35-38) ORIGIN OF CONTINUOUS SPECTRA IN e + N_2 SCATTERING. Pavlovic, M.; Pavlovic, Z. (Institute "Rudjer Boskovic", Zagreb). 1974.

From 7th symposium on physics of ionized gases; Rovinj, Yugoslavia (16 Sep 1974).

In seventh Yugoslav symposium on physics of ionized gases.

The resonance observed at about 22 eV is treated as a multiparticle process in which the excitation energy is distributed among many electrons. The statistical approach as given in nuclear physics is applied. Part of the spectrum measured at low energies in the range from 0.1 -5 eV is shown. (20 refs, 1 figure) (GHT)

7444 (CONF-740985-, pp 43-46) IONIZATION AND CHARGE EXCHANGE CROSS SECTIONS IN COLLISIONS BETWEEN HEAVY, MULTICHARGED IONS AND NEUTRAL ATOMS. Moriette, P. (CEN, Fontenay-aux-Roses, France). 1974.

From 7th symposium on physics of ionized gases; Rovinj, Yugoslavia (16 Sep 1974).

In seventh Yugoslav symposium on physics of ionized gases.

Calculations are given showing the relationship of the cross sections to the relative velocity and bound electron velocity. Cross sections are calculated for ionization of H, D, and He atoms by C^{6+}, O^{8+}, and Mo^{32+} ions and, compared with experimental data, good agreement is obtained. (3 figures) (GHT)

7445 (CONF-740985-, pp 51-54) ELECTRON CAPTURE BY GROUND-STATE AND METASTABLE Li^+ IONS IN VARIOUS GASES. Baastrup, E.; Hvelplund, P. (Univ. of Aarhus, Denmark). 1974.

From 7th symposium on physics of ionized gases; Rovinj, Yugoslavia (16 Sep 1974).

In seventh Yugoslav symposium on physics of ionized gases.

Electron capture by Li^+ ions is shown to be an efficient way of producing metastable Li^+ ions. Cross sections for capture into autoionization states and states metastable against autoionization are shown. The experimental apparatus is described. (3 figures) (GHT)

7446 (CONF-740985-, pp 55-58) MASS SPECTROMETRIC STUDY OF NEGATIVE IONS FORMATION IN SO_2. Djuric-Pregerl, N. (Inst. of Physics, Belgrade); Stamatovic, A.; Miletic, M.; Maksic, R. 1974.

From 7th symposium on physics of ionized gases; Rovinj, Yugoslavia (16 Sep 1974).

In seventh Yugoslav symposium on physics of ionized gases.

Negative ion formation from low energy (3-10 eV) electron collisions with SO_2 molecules was studied with both a quadrupole and a 90° sector magnetic analyzer. The quadrupole results are compared with earlier measurements of the total negative ion current, and good agreement is obtained. Calculated onset potentials for the various reaction paths are compared with experimental results from the 90° sector spectrometer. (GHT)

7447 (CONF-740985-, pp 59-62) NEGATIVE ION METASTABLE PEAKS IN SO_2. Stamatovic, A. (Inst. of Physics, Belgrade). 1974.

From 7th symposium on physics of ionized gases; Rovinj, Yugoslavia (16 Sep 1974).

In seventh Yugoslav symposium on physics of ionized gases.

The ion formation processes for SO_2 are examined to explain the appearance of metastable peaks in the negative ion mass spectrum. Several probable formation processes for the metastable ions are given. (GHT)

7448 (CONF-740985-, pp 65-67) IONIZATION FUNCTIONS FOR $e-He^+$ AND $e-He$ COLLISIONS NEAR THRESHOLDS. Cvejanovic, S.; Grujic, P. (Inst. of Physics, Belgrade). 1974.

From 7th symposium on physics of ionized gases; Rovinj, Yugoslavia (16 Sep 1974).

In seventh Yugoslav symposium on physics of ionized gases.

The classical trajectory method is used to investigate the numerically classical theory for the electron-atom ionization threshold law. A computer program, modified to deal with low energy electron-ion scattering and extended to a four-body problem, was used to calculate particle trajectories by solving corresponding differential equations for Coulomb interactions. Ionization intervals for $e-He^+$ collisions are given. (GHT)

7449 (CONF-740985-, pp 163-166) ADHESION OF SPUTTERED DENTAL GOLD THIN FILMS. Cobic, D.; Nenadovic, T.; Adamov, M.; Perovic, B. (Boris Kidric Inst. of Nuclear Sciences, Belgrade). 1974.

From 7th symposium on physics of ionized gases; Rovinj, Yugoslavia (16 Sep 1974).

In seventh Yugoslav symposium on physics of ionized gases.

An experimental determination of the adhesion of thin films of dental gold to various substrates is described. Results are shown for glass, acrylate, and lacquer-coated acrylate substrates for films obtained by sputtering. Adhesion is shown as a function of sputtering energy and as a function of substrate temperature. Comparison is made to adhesion values of evaporated thin films. (2 figs.) (GHT)

7450 (CONF-740985-, pp 171-174) EFFECT OF ION BOMBARDMENT ON THE STRAIN-GAUGE FACTOR OF THIN GOLD FILMS. Robinson, R. G. (Cambridgeshire Coll. of Arts and Tech., Cambridge, Eng.); Stephens, K. G.; Wilson, I. H. 1974.

From 7th symposium on physics of ionized gases; Rovinj, Yugoslavia (16 Sep 1974).

In seventh Yugoslav symposium on physics of ionized gases.

Gold films, evaporated onto soda glass substrates, were thinned by argon ion bombardment. The strain gage factor measurements made on the resulting thinned films are described. Gage resistance vs. ion bombardment dose, strain gage factor vs sheet resistance, temperature coefficient vs. sheet resistance, and gage resistance vs time after bombardment are shown. The results are discussed. (4 figs). (GHT)

7451 (CONF-740985-, pp 253-255) DETERMINATION OF Cs INTERACTION POTENTIALS FROM WINGS OF SELF-BROADENED PRINCIPAL SERIES LINES. Niemax, K.; Pichler, G. (Univ., Kiel, Ger.). 1974.

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The self-broadening of higher principal series lines ($6\ ^2S_{\frac{1}{2}} \rightarrow 7\text{-}18\ ^2P_{\frac{1}{2}}$ and $6\ ^2S_{\frac{1}{2}} \rightarrow 7\text{-}11\ ^2P_{\frac{3}{2}}$) were investigated in absorption with a high resolution spectrometer. Typical measured line wings are shown. The arrangement of the potentials belonging to a higher excited state is shown qualitatively, and C_6 versus n^* is shown. (3 figs.) (GHT)

7452 (CRN/CNPA-74-26) ENERGY LOSS OF HEAVY IONS IN NUCLEAR COLLISIONS IN SILICON. Grob, J. J.; Grob, A.; Pape, A.; Siffert, P. (Centre National de la Recherche Scientifique, 67 - Strasbourg (France). Centre de Recherches Nucleaires). 1974. 25p. Dep. NTIS (US Sales Only) $4.25.

Heavy ion channelling measurements performed in aligned surface barrier detectors have allowed the determination of energy losses and straggling in nuclear collisions. Results are presented for $^{28}Si^+$ and $^{14}N^+$ in the 300 to 2000 keV region to illustrate the possibilities of this method. Comparisons of the theoretical and experimental data are made. A dependence of the energy partition between electronic and nuclear collisions on the atomic density along the ion path is demonstrated. (auth)

7453 DECREASE IN THE OBSERVED EXCITED-ION ELECTRON CAPTURE CROSS SECTIONS DUE TO AUTOIONIZATION. Nikolaev, V. S.; Dmitriev, I. S.; Tashaev, Y. A.; Teplova, Y. A.; Fainberg, Y. A. (Moscow State Univ.). J. Phys., B (London); 8: No. 4, L58-L60(11 Mar 1975).

From measurements of the cross sections for electron capture by fast helium-like ions N^{5+} produced by three different methods, it was found that by increasing the number of metastable particles in an ion beam from 3 to 40%, the electron capture cross section is decreased approximately twice. The use of results of previous investigations clearly shows that this decrease is due to autoionization of lithium-like ions N^{4+} produced from electron capture. It is suggested that the autoionization mechanism may also account for the previously observed anomalies in the electron capture cross sections for P^{5+}, Br^{7+}, and I^{7+} ions and the decreased charge-exchange cross sections for He^+ and N^+ metastable ions. (auth)

7454 EFFECT OF POST-COLLISION INTERACTION IN N ^3S EXCITATION OF HELIUM BY ELECTRONS. Heideman, H. G. M.; van Ittersum, T.; Nienhuis, G.; Hol, V. M. (Rijksuniversitet Utrecht, Netherlands). J. Phys., B (London); 8: No. 3, L26-L28(21 Feb 1975).

The excitation of the 4 ^3S, 5 ^3S, 6 ^3S and 4 ^3D states of helium by electron impact was studied in the energy region around 60 eV. New experimental evidence was obtained for the existence of an indirect excitation mechanism resulting from a post-collision interaction (PCI) between the scattered electron and the electron ejected from an intermediate autoionizing state. It is found, and made plausible, that the PCI mechanism via the excitation of autoionizing states primarily leads to the excitation of S-states. (auth)

7455 COLLISION STRENGTHS FOR [N II], [O III], [Ne II], AND [Ne III]. Seaton, M. J. Mon. Notic. Roy. Astron. Soc.; 170: No. 3, 475-486(Mar 1975).

New calculations give collision strengths for [N II], [O III], [Ne II], and [Ne III] correct to within 10%. The results are tabulated in a form convenient for the interpretation of observations. (auth)

7456 NE K-SHELL VACANCY PRODUCTION BY INTERMEDIATE ENERGY F IONS. Woods, C. W.; Kauffman, R. L.; Jamison, K. A.; Stolterfoht, N.; Richard, P. (Kansas State Univ., Manhattan). J. Phys., B (London); 8: No. 4, L61-L64(11 Mar 1975).

The energy dependence of the Ne K-shell Auger electron production cross section is presented for various charge states of the F projectile from 3 to 35 MeV. This spans the intermediate energy range for K-shell vacancy production from the low energy region where molecular promotion dominates to the high energy region where Coulomb ionization dominates. (auth)

7457 ON THE USE OF THE BREIT-PAULI APPROXIMATION IN THE STUDY OF RELATIVISTIC EFFECTS IN ELECTRON-ATOM SCATTERING. Jones, M. (University Coll., London). Phil. Trans. Roy. Soc. London, Ser. A; 277: No. 1273, 587-622(30 Jan 1975).

The electron-atom scattering problem is formulated by using the Breit-Pauli hamiltonian, and the Kohn variational principle is derived for this hamiltonian. Two distinct types of relativistic corrections are considered separately: (1) relativistic corrections due to the motion of the colliding electron and its interaction with the target; (2) relativistic corrections due to breakdown of LS-coupling in the target. In both of these cases it is shown that within the Breit-Pauli approximation a collision strength may be written $\Omega^{rel}(i,j) = \Omega^{nr}(i,j) + \alpha^2 C^{(2)}_{rel}(i,j) + \alpha^4 C^{(4)}_{rel}(i,j)$, where Ω^{rel} is the collision strength including relativistic corrections and Ω^{nr} is the nonrelativistic collision strength. The quantities $C^{(2)}_{rel}$ and $C^{(4)}_{rel}$ are contributions of orders α^2 and α^4 respectively, relative to Ω^{nr}. In the case of corrections of type (1), consistency problems render it difficult to calculate the term $\alpha^4 C^{(4)}_{rel}$ reliably. On the other hand, strong semi-empirical evidence suggests that in the case of corrections of type (2), the α^4 correction can be reliably estimated within the framework of existing theory. By means of Racah algebra it is demonstrated that fine structure interactions between colliding electron and target give no contributions of order α^2 provided that $\Omega^{rel}(i,j)$ is summed over the fine structure levels of the initial and final target terms. Breakdown of LS-coupling in the target gives contribution of order α^2 to the total collision strength. Practical procedures for carrying out calculations in the

framework of the present theory are discussed, and one such procedure is formulated in some detail. (auth)

7458 COMMON TRAJECTORY METHODS FOR THE CALCULATION OF DIFFERENTIAL CROSS SECTIONS FOR INELASTIC TRANSITIONS IN ATOM(ION)-ATOM COLLISIONS. II. Application to Proton–Hydrogen Scattering. Gaussorgues, C.; Le Sech, C.; Masnou-Seeuws, F.; Riera, A. (Observatoire de Paris, Section de Meudon, France). J. Phys., B (London); 8: No. 2, 253-264(1 Feb 1975).

As an application of the semiclassical method presented in (Gaussorgues et al. J. Phys. B. Atom. Molec. Phys.; 8: 239-52 (1975)), the elastic and inelastic, direct and exchange differential cross sections for proton-hydrogen collisions are calculated using a three-term molecular basis. The results of the common trajectory method are shown to agree with experiment (in the energy range 250 to 1000 eV) for relatively large angles, where the straight line eikonal method begins to show significant deviations. It is emphasized that the present treatment is not much more complicated numerically than the rectilinear model. A limit of validity to the straight line eikonal method is thus obtained. The sensitivity of the results to the explicit choice of trajectory is studied. The validity of the stationary phase approximation is tested in view of its popularity in other semiclassical treatments. (auth)

7459 ELECTRON LOSS AND COLLISIONAL DESTRUCTION OF FAST $He^+(2S)$ IONS AND APPLICATION TO A POLARIZED ^3He ION SOURCE. Shah, M. B.; Gilbody, H. B. (Queen's Univ., Belfast). J. Phys., B (London); 8: No. 3, 372-381(21 Feb 1975).

A modulated beam technique was used to determine cross sections for one-electron loss $\sigma_{l\cdot 2}$ and total cross sections σ_D for collisional destruction of 18 to 50 keV $^3He^+(2S)$ metastable ions in H_2, He, Ar, N_2 and O_2. Cross sections $\sigma_{l\cdot 2}$ are shown to be roughly 100 times larger than the corresponding one-electron loss cross sections for ground state He^+ ions. Total collisional destruction cross sections σ_D, which are very large ($\sim 10^{-15}$ cm^2) and not greatly energy dependent, indicate that electron loss is not the dominant destruction mechanism in the present energy range. The results are shown to be consistent with the requirements of a recently proposed source of polarized ^3He ions. Data relevant to the optimization of such a source are presented. (auth)

7460 A NEW TEST CALCULATION FOR THE ELASTIC SCATTERING OF ELECTRONS BY HYDROGEN ATOMS. Hashino, T.; Nakazaki, S. (Miyazaki Univ. (Japan). Faculty of Engineering). Miyazaki Daigaku Kogakubu Kenkyu Hokoku; No. 19, 77-79 (Aug 1973). (In Japanese).

Using a Gaussian type of the atomic wave function of hydrogen atoms in the ground state, we researched the elastic scattering of electrons by atoms in the both static field and exchange approximations. Our results are compared with the exact one. In the static field approximation, the agreement is very satisfactory in the all range of the wave number. In the exchange approximation, the agreement is satisfactory in the range of the wave number except slow incident electron energies. (auth)

7461 LOW ENERGY ION-NEUTRAL REACTIONS. IV. Formation of NO^+ and N_2^+ in $O^+ + N_2$ Collisions. Kaneko, Y.; Kobayashi, N. (Tokyo Metropolitan Univ. (Japan). Dept. of Physics). J. Phys. Soc. Jap.; 36: No. 6, 1649-1654(Jun 1974).

Cross sections for formation of NO^+ and N_2^+ in $O^+ + N_2$ collisions are measured by the injected-ion drift tube technique from 0.04 eV to 3 eV in the center of mass system. The cross section curve obtained for N_2^+ formation is used to determine the fractional density of the excited state ions in the primary O^+ beam. The cross section for NO^+ formation by $O^+(^4S)$ has a minimum at 0.12 eV, and increases rapidly with the collision energy. The minimum value is determined as 9×10^{-18} cm^2 with 50% accuracy. The results obtained are compared with the previous works. The cross section for NO^+ formation by $O^+(^2D)$ at the same energy is tentatively determined as 1.2×10^{-16} cm^2, and it can be larger if the collisional deexcitation of the ^2D state, possible in the drift tube, has to be taken into account. These results may be useful for the ionospheric research. (auth)

7462 COMMON TRAJECTORY METHODS FOR THE CALCULATION OF DIFFERENTIAL CROSS SECTIONS FOR INELASTIC TRANSITIONS IN ATOM(ION)-ATOM COLLISIONS. I. General Theory. Gaussorgues, C.; Le Sech, C.; Masnou-Seeuws, F.; McCarroll, R.; Riera, A. (Observatoire de Paris, Section de Meudon, France). J. Phys., B (London); 8: No. 2, 239-252(1 Feb 1975).

Starting from a partial wave decomposition of the quantum-mechanical equations, a systematic development of the semiclassical theory of inelastic transitions in slow atom(ion)-atom collisions is presented. Both atomic and molecular representations are discussed. It is shown that the introduction of an average potential reduced the semiclassical equations to the well known impact parameter equations; the notions of the classical trajectory and the classical collision plane arise as a natural consequence of the semiclassical approximation. Expressions for the differential scattering cross sections for inelastic transitions are subsequently derived. The connection with the straight line eikonal approximation is discussed. (auth)

7463 EXPERIMENTAL INVESTIGATION OF THE COLLISION OF NEUTRAL PARTICLES IN THE ELECTRON-VOLT (eV) ENERGY REGION. Leonas, V. B. Khim. Plazmy; No. 1, 234-302(1974). (In Russian).

The results of studies on the collision of neutral atoms and molecules are critically reviewed. The techniques for the study of the interaction of atomic particles in the eV energy range are first examined. Some results obtained in the study of the elastic scattering and determination of the interaction potential and on inelastic collisions of neutral particles are discussed. 63 references. (JSR)

7464 DISSOCIATION OF MOLECULES BY ELECTRON COLLISIONS. Slovetskii, D. I. Khim. Plazmy; No. 1, 156-202(1974). (In Russian).

In this critical review methods and results of the measurement of the total dissociation cross section of molecules by electron collision are described. The contribution of the different processes to the total cross section is analyzed. The distinctions in the role of dissociative ionization and dissociative capture are not discussed completely, but are introduced only to illustrate the contribution of these processes to the total cross section of dissociation by electrons. It is shown that the process of dissociation by excitation of electron levels is the most general for all molecules and the most significant for the majority of them. Methods for the calculation of the cross section and of the rate coefficients for the dissociation of molecules by electron levels are described, and the results of such calculations are reported for a number of molecules. Special attention is given to the effect of the internal degrees of freedom of the molecule on the cross section and the rate coefficients. 138 references. (JSR)

7465 BROADENING, SHIFT, AND DEPOLARIZATION OF BROAD FINE STRUCTURE ALKALI SPECTRAL LINES BY HELIUM. Roueff, E.; Suzor, A. (Observatoire de Paris, Section de Meudon, 92 (France)). J. Phys. (Paris).; 35: No. 10, 727-740 (Oct 1974).

Due to the large values of the fine structure interval for the first resonance lines of Rb and Cs, the $^2P_{\frac{1}{2}}$ and $^2P_{\frac{3}{2}}$ atomic levels may be treated separately when perturbed by helium atoms. Within the framework of semi-classical and impact approximations, and assuming an exchange interaction, the diffusion matrices $S^{\frac{1}{2}}$ and $S^{\frac{3}{2}}$ are numerically computed; firstly by neglecting all $\frac{1}{2}$-$\frac{3}{2}$ coupling, and secondly, by a more accurate treatment which makes use of the molecular potentials and shows that the D_1-lines depolarization is entirely due to the short range nonadiabatic coupling. The validity of analytical approximate resolutions for asymptotic regions is studied, and also the trajectory for the $P_{\frac{3}{2}}$ levels, correlated with a single molecular curve; the rectilinear assumption appears to be insufficient for very short range phenomena. The agreement with experimental results confirms that the exchange interaction predominates for intermediate distances. (FR)

7466 EXCHANGE AND NUCLEAR SYMMETRY INTERFERENCE IN He^+–He SCATTERING. Boyle, J. F.; Kennedy, M.; Smith, F. J. (Queen's Univ., Belfast). Mol. Phys.; 29: No. 3, 681-691(Mar 1975).

A method is described to determine the potential difference, $V_g - V_u$, that will accurately reproduce the exchange and nuclear symmetry oscillations observed by Aberth et al. in their experimental works on He^+-He differential scattering. It is demonstrated that at higher energies and angles the experimental results for $^4He^+$-^4He, $^4He^+$-^3He and $^3He^+$-^3He appear incompatible with one another when investigated in terms of a two-state scattering theory. This is an indication that at these energies and angles the theory may require modification to include the effects of coupling to higher states. (auth)

7467 ELECTRON CAPTURE PROCESSES OF MULTIPLY CHARGED ARGON IONS IN ARGON AT ENERGIES FROM 10 TO 90 keV. Klinger, H.; Mueller, A.; Salzborn, E. (Univ., Giessen, Ger.). J. Phys., B (London); 8: No. 2, 230-238(1 Feb 1975).

The cross sections for the transfer of up to four electrons in single collisions between multiply charged ions (up to Ar^{7+}) and argon atoms are measured. The cross sections (σ_{21} excepted) show no significant energy dependence in the investigated energy range from 5 to 15 keV times charge state number. Their values are between 4×10^{-17} cm^2 for the transfer of four electrons to

7446 (CONF-740985-, pp 55-58) MASS SPECTROMETRIC STUDY OF NEGATIVE IONS FORMATION IN SO_2. Djuric-Pregerl N. (Inst. of Physics, Belgrade); Stamatovic, A.; Miletic, M.; Maksic, R. 1974.

From 7th symposium on physics of ionized gases; Rovinj, Yugoslavia (16 Sep 1974).

In seventh Yugoslav symposium on physics of ionized gases.

Negative ion formation from low energy (3-10 eV) electron collisions with SO_2 molecules was studied with both a quadrupole and a 90° sector magnetic analyzer. The quadrupole results are compared with earlier measurements of the total negative ion current, and good agreement is obtained. Calculated onset potentials for the various reaction paths are compared with experimental results from the 90° sector spectrometer. (GHT)

7447 (CONF-740985-, pp 59-62) NEGATIVE ION METASTABLE PEAKS IN SO_2. Stamatovic, A. (Inst. of Physics, Belgrade). 1974.

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The ion formation processes for SO_2 are examined to explain the appearance of metastable peaks in the negative ion mass spectrum. Several probable formation processes for the metastable ions are given. (GHT)

7448 (CONF-740985-, pp 65-67) IONIZATION FUNCTIONS FOR $e-He^+$ AND $e-He$ COLLISIONS NEAR THRESHOLDS. Cvejanovic, S.; Grujic, P. (Inst. of Physics, Belgrade). 1974.

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The classical trajectory method is used to investigate the numerically classical theory for the electron-atom ionization threshold law. A computer program, modified to deal with low energy electron-ion scattering and extended to a four-body problem, was used to calculate particle trajectories by solving corresponding differential equations for Coulomb interactions. Ionization intervals for $e-He^+$ collisions are given. (GHT)

7449 (CONF-740985-, pp 163-166) ADHESION OF SPUTTERED DENTAL GOLD THIN FILMS. Cobic, D.; Nenadovic, T.; Adamov, M.; Perovic, B. (Boris Kidric Inst. of Nuclear Sciences, Belgrade). 1974.

From 7th symposium on physics of ionized gases; Rovinj, Yugoslavia (16 Sep 1974).

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An experimental determination of the adhesion of thin films of dental gold to various substrates is described. Results are shown for glass, acrylate, and lacquer-coated acrylate substrates for films obtained by sputtering. Adhesion is shown as a function of sputtering energy and as a function of substrate temperature. Comparison is made to adhesion values of evaporated thin films. (2 figs.) (GHT)

7450 (CONF-740985-, pp 171-174) EFFECT OF ION BOMBARDMENT ON THE STRAIN-GAUGE FACTOR OF THIN GOLD FILMS. Robinson, R. G. (Cambridgeshire Coll. of Arts and Tech., Cambridge, Eng.); Stephens, K. G.; Wilson, I. H. 1974.

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Gold films, evaporated onto soda glass substrates, were thinned by argon ion bombardment. The strain gage factor measurements made on the resulting thinned films are described. Gage resistance vs. ion bombardment dose, strain gage factor vs sheet resistance, temperature coefficient vs. sheet resistance, and gage resistance vs time after bombardment are shown. The results are discussed. (4 figs). (GHT)

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Starting from a partial wave decomposition of the quantum-mechanical equations, a systematic development of the semiclassical theory of inelastic transitions in slow atom(ion)-atom collisions is presented. Both atomic and molecular representations are discussed. It is shown that the introduction of an average potential reduced the semiclassical equations to the well known impact parameter equations; the notions of the classical trajectory and the classical collision plane arise as a natural consequence of the semiclassical approximation. Expressions for the differential scattering cross sections for inelastic transitions are subsequently derived. The connection with the straight line eikonal approximation is discussed. (auth)

7463 EXPERIMENTAL INVESTIGATION OF THE COLLISION OF NEUTRAL PARTICLES IN THE ELECTRON-VOLT (eV) ENERGY REGION. Leonas, V. B. Khim. Plazmy; No. 1, 234-302(1974). (In Russian).

The results of studies on the collision of neutral atoms and molecules are critically reviewed. The techniques for the study of the interaction of atomic particles in the eV energy range are first examined. Some results obtained in the study of the elastic scattering and determination of the interaction potential and on inelastic collisions of neutral particles are discussed. 63 references. (JSR)

7464 DISSOCIATION OF MOLECULES BY ELECTRON COLLISIONS. Slovetskii, D. I. Khim. Plazmy; No. 1, 156-202(1974). (In Russian).

In this critical review methods and results of the measurement of the total dissociation cross section of molecules by electron collision are described. The contribution of the different processes to the total cross section is analyzed. The distinctions in the role of dissociative ionization and dissociative capture are not discussed completely, but are introduced only to illustrate the contribution of these processes to the total cross section of dissociation by electrons. It is shown that the process of dissociation by excitation of electron levels is the most general for all molecules and the most significant for the majority of them. Methods for the calculation of the cross section and of the rate coefficients for the dissociation of molecules by electron levels are described, and the results of such calculations are reported for a number of molecules. Special attention is given to the effect of the internal degrees of freedom of the molecule on the cross section and the rate coefficients. 138 references. (JSR)

7465 BROADENING, SHIFT, AND DEPOLARIZATION OF BROAD FINE STRUCTURE ALKALI SPECTRAL LINES BY HELIUM. Roueff, E.; Suzor, A. (Observatoire de Paris, Section de Meudon, 92 (France)). J. Phys. (Paris).; 35: No. 10, 727-740 (Oct 1974).

Due to the large values of the fine structure interval for the first resonance lines of Rb and Cs, the $^2P_{\frac{1}{2}}$ and $^2P_{\frac{3}{2}}$ atomic levels may be treated separately when perturbed by helium atoms. Within the framework of semi-classical and impact approximations, and assuming an exchange interaction, the diffusion matrices $S^{\frac{1}{2}}$ and $S^{\frac{3}{2}}$ are numerically computed; firstly by neglecting all $\frac{1}{2}$-$\frac{3}{2}$ coupling, and secondly, by a more accurate treatment which makes use of the molecular potentials and shows that the D_1-lines depolarization is entirely due to the short range nonadiabatic coupling. The validity of analytical approximate resolutions for asymptotic regions is studied, and also the trajectory for the $P_{\frac{3}{2}}$ levels, correlated with a single molecular curve; the rectilinear assumption appears to be insufficient for very short range phenomena. The agreement with experimental results confirms that the exchange interaction predominates for intermediate distances. (FR)

7466 EXCHANGE AND NUCLEAR SYMMETRY INTERFERENCE IN He^+–He SCATTERING. Boyle, J. F.; Kennedy, M.; Smith, F. J. (Queen's Univ., Belfast). Mol. Phys.; 29: No. 3, 681-691(Mar 1975).

A method is described to determine the potential difference, $V_g - V_u$, that will accurately reproduce the exchange and nuclear symmetry oscillations observed by Aberth et al. in their experimental works on He^+-He differential scattering. It is demonstrated that at higher energies and angles the experimental results for $^4He^+$-^4He, $^4He^+$-^3He and $^3He^+$-^3He appear incompatible with one another when investigated in terms of a two-state scattering theory. This is an indication that at these energies and angles the theory may require modification to include the effects of coupling to higher states. (auth)

7467 ELECTRON CAPTURE PROCESSES OF MULTIPLY CHARGED ARGON IONS IN ARGON AT ENERGIES FROM 10 TO 90 keV. Klinger, H.; Mueller, A.; Salzborn, E. (Univ., Giessen, Ger.). J. Phys., B (London); 8: No. 2, 230-238(1 Feb 1975).

The cross sections for the transfer of up to four electrons in single collisions between multiply charged ions (up to Ar^{7+}) and argon atoms are measured. The cross sections (σ_{21} excepted) show no significant energy dependence in the investigated energy range from 5 to 15 keV times charge state number. Their values are between 4×10^{-17} cm^2 for the transfer of four electrons to

$Ar^{8+}(\sigma_{II})$ and 9×10^{-15} cm^2 for the transfer of one electron to $Ar^{7+}(\sigma_{III})$. (auth)

7468 BROADENING OF Na 3p–3s AND K 5p–4s LINES BY HELIUM. A Discussion of Experimental and Theoretical Results. Kunth, D.; Masnou-Seeuws, F.; Rostas, F.; Roueff, E. (Observatoire de Paris, Section de Meudon, France). J. Phys., B (London); 8: No. 2, 203-211(1 Feb 1975).

Experimental and theoretical results concerning the broadening of Na 3p-3s (5890 to 96 Å) and K 5p-4s (4044 to 47 Å) lines by helium are compared and discussed in the light of simplified collision models referring to the molecular Hund's coupling cases. The two lines of the sodium multiplet are almost equally broadened while those of potassium differ appreciably. This is attributed to the increased importance of the coupling case for potassium corresponding to a reduced angular velocity of the internuclear axis during K-He collisions which is due to the much larger diameter of the potassium atom. (auth)

7469 SCATTERING AND ANNIHILATION CROSS SECTIONS OF POSITRONS WITH ARGON. Hara, S.; Fraser, P. A. (Univ. of Western Ontario, London). J. Phys., B (London); 8: No. 2, 219-229(1 Feb 1975).

The effective number of annihilation electrons (Z_{eff}), the scattering length and s-wave phase shift of the positron-Ar system were determined empirically below the threshold of positronium formation by requiring that the calculated temperature and electric field dependence of the equilibrium annihilation rate, the lifetime spectrum and the elastic scattering cross section agree with experiment. In atomic units, the velocity dependence of Z_{eff} may be represented by $Z_{eff}(v) = 15.0 + 45.25 \exp(-30.66v)$, and the scattering length appears to lie between –4.0 and –3.0. (auth)

Atomic Theory

7470 WIDTH OF SPECTRAL LINES. Peach, G. (University Coll., London). Contemp. Phys.; 16: No. 1, 17-34(Jan 1975).

A spectral line emitted by an atom or molecule (throughout the article, spectral lines seen in emission are described; however, the theory applies equally well to the absorption of radiation in plasmas) has a finite width, and there are three distinct physical processes which contribute to this broadening. The energy levels between which the transition takes place have a natural width, which arises from the reaction of the radiation field on matter. This means that an atom has a finite time in any level before spontaneous decay takes place. Also the emitting atom may be moving in the line of sight, which produces an apparent change in the line frequency through the Doppler effect. Finally, broadening of the spectral line is caused by the interaction of the emitting atom with surrounding particles in the plasma. Thus a detailed analysis of line shapes can yield much information on the density, temperature and motion of plasmas, whether they are high density plasmas created in the laboratory, or the lower density plasmas of interest in astrophysics, such as the solar corona or the interstellar medium. (auth)

7471 NECESSARY AND SUFFICIENT CONDITIONS OF SEPARABILITY FOR FERMION WAVE FUNCTIONS: THEORETICAL BASIS OF A GROUP-DENSITY-ANALYSIS METHOD. Constanciel, R. (Univ., Paris). Phys. Rev., A; 11: No. 2, 395-402(Feb 1975).

A theorem is proved which gives the necessary and sufficient conditions on the p-particle reduced-density operator restricted to a functional subspace that ensures the separability of the wave function of a fermion system. This theorem is the theoretical basis of a general method of analyzing atomic and molecular wave functions, a method which is able to reveal the existence of somehow chemically discernible subsystems of electrons. (auth)

7472 BOUND STATES IN THE CONTINUUM. Stillinger, F. H.; Herrick, D. R. (Bell Labs., Murray Hill, NJ). Phys. Rev., A; 11: No. 2, 446-454(Feb 1975).

Quantum-mechanical examples were constructed of local potentials with bound eigenstates embedded in the dense continuum of scattering states. The method employed corrects and extends a procedure invented by von Neumann and Wigner. Cases are cited whereby deformation of the local potential causes the continuum bound state to move downward through the bottom of the continuum, and to connect analytically to a nodeless ground state. A doubly excited model atom is also displayed, with interactions between its two "electrons," having an infinite lifetime (in the Schrodinger equation regime). In the light of these examples, attention is focused on quantitative interpretation of real tunneling phenomena, and on the existence of continuum bound states in atoms and molecules. (auth)

PHYSICS (ELECTROFLUID AND MAGNETOFLUID)

7473 SOME POTENTIAL FUNCTIONS IN MAGNETOHYDRODYNAMICS. Vacca, M. T. Atti Accad. Naz. Lincei, Rend., Cl. Sci. Fis., Mat. Natur.; 52: No. 3, 357-366(Mar 1972). (In Italian).

An incompressible viscous indefinite and electrically conductive fluid slowly moving under the action of a uniform magnetic field and body forces distributed with continuity in a fixed region of the medium is considered. Two procedures are given for reduction of this problem. In the case where the induced magnetic field is sufficiently small compared with the body forces, solutions of the velocity field, induced magnetic field, and pressure field are determined. These solutions are expressed by definite integrals which, having an analogy with the Newtonian volume potentials, are called hydrodynamic and magnetic potentials. (Appl. Mech. Rev.)

7474 PROBLEM OF ASYMMETRIC MAGNETOHYDRODYNAMICS. Petrosyan, L. G. Izv. Akad. Nauk Arm. SSR, Ser. Mekh.; 27: No. 6, 44-55(1974). (In Russian).

The equations of asymmetric magnetohydrodynamics are examined; the equations of continuous electrically conducting liquid of great or infinite electroconductivity are derived, the presence of coupled stresses in liquid, the asymmetry of stress tensor and the rotation inertia of liquid particles being taken into account. The general case of uniform flow in the duct is discussed. The solution to the problem of one-dimensional steady laminar flow of incompressible fluid of constant viscosity and electroconductivity between two plane parallel isolated walls in a homogeneous transverse magnetic field is presented. (auth)

7475 PROBLEM ON DIFFRACTION OF A STRONG MAGNETOGASDYNAMIC SHOCK WAVE AT A WEDGE. Azatyan, L. D. (Erevan State Univ.). Izv. Akad. Nauk Arm. SSR, Ser. Mekh.; 27: No. 5, 47-62(1974). (In Russian).

A region of non-uniform flow is investigated in the problem on reflection of a magnetogasdynamic strong shock wave from an angle close to π in the presence of a magnetic field parallel to incident shock. The problem for the above region is reduced by the Smirnov—Sobolev method to a boundary problem for analytic function (pressure). The solution is obtained by the Lighthill method. Wall-pressure distribution is determined and numerical calculation is presented. (auth)

7476 PLANE PROBLEM OF PROPAGATION OF MAGNETOELASTIC WAVES IN PERFECTLY CONDUCTING ISOTROPIC MEDIA. Danoyan, Z. N. (Inst. of Mechanics, Erevan). Izv. Akad. Nauk Arm. SSR, Ser. Mekh.; 27: No. 5, 27-46(1974). (In Russian).

The problem of propagation elastic waves in infinite isotropic media in the presence of a magnetic field is considered in terms of Smirnov—Sobolev's complex solutions method. The functional—invariant solutions are examined as plane waves of two types in the plane problem of magnetoelasticity. The variation in velocity of propagation of waves depending both on magnitude of the magnetic field and ion angle between the direction of the magnetic field and the normal to the wave is investigated. According to the results obtained the magnetoelastic waves are divided into fast and slow ones. The graphs of velocities of the waves are presented. (auth)

PHYSICS (HIGH-ENERGY)

Particle Interactions and Properties (Experimental)

Refer also to abstracts 7253, 7523, 7537, and 7538.

7477 (N-74-32178) MULTIPLE PARTICLE PRODUCTION. Zhdanov, G. B. Aug 1974. Translation of Mnozhestvennaya Generatsiya Chastits. (NASA-TT-F-15757). 200p. NTIS $13.00.

Experimental methods of studying multiple particle generation with the aid of cosmic rays and powerful charged particle accelerators are reported. (auth)

7478 THE DEPARTMENT OF PHYSICS OF ELEMENTARY PARTICLES OF THE SACLAY NUCLEAR RESEARCH CENTER. Berthelot, A. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physique des Particules Elementaires). Bull. Inf. Sci. Tech. (Paris).; No. 198, 3-9 (Dec 1974). (In French).

The structure of the Saclay Elementary Particle Physics Department is reviewed. The performance of the accelerators at the disposal of this department and the current program are examined. (FR)

7479 HIGH ENERGY PHYSICS INDEX. Volume 13, No. 3, 1975. Leopoldshafen, Ger.; Zentralstelle fuer Atomkernenergie-Dokumentation (1975). 85p.

Electromagnetic

7480 (DESY-75/07) MUON PAIR PRODUCTION BY e^+e^- ANNIHILATION AT THE 3100 MeV RESONANCE. DASP Collaboration. Braunschweig, W.; Koenigs, E.; Jordan, C. L. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (F. R. Germany)). Mar 1975. 11p. Dep. NTIS (US Sales Only) $4.00.

Results for μ pair production in e^+e^- collisions at the 3100 MeV resonance are reported. A resonance cross section, integrated over total energy of 1240 ± 140 nb-MeV implying $\Gamma_{\mu\mu}\Gamma_{ee}/\Gamma_{tot}$ = 0.51 ± 0.09 keV was found. The angular distribution is consistent with $\sim(1 + \cos^2\theta)$. No forward-backward asymmetry is observed. (auth)

7481 (ORO-4856-10) EXPERIMENTAL TEST OF CHARGE CONSERVATION AND THE STABILITY OF THE ELECTRON. Steinberg, R. I.; Kwiatkowski, K.; Maenhaut, W.; Wall, N. S. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy). Apr 1975. Contract AT(40-1)-4856. 12p. Dep. NTIS $4.00.

A new experimental lower limit of 5.3×10^{21} years for the lifetime of the electron against decay into neutrinos is reported. Any finite value for this lifetime would have implied a breakdown of the law of charge conservation. The experimental technique consists of a search for the internally-absorbed 11.1-keV x-ray and Auger-electron cascade which would follow the decay of a K-shell electron in a germanium atom in a high resolution Ge(Li) detector. (auth)

7482 SEARCH FOR NARROW RESONANCES IN e^+e^- ANNIHILATION IN THE MASS REGION 3.2 TO 5.9 GeV. Boyarski, A. M. (Stanford Univ., CA); Breidenbach, M.; Bulos, F. Phys. Rev. Lett.; 34: No. 12, 762-763 (24 Mar 1975).

The mass region 3.2 to 5.9 GeV was searched for evidence of narrow resonances in e^+e^- yields hadrons. No evidence was found for any such resonances other than the psi (3695) in this region with a sensitivity ranging from about 12 to 45 percent of the integrated cross section of the psi (3695). The more stringent bounds apply to resonances of a few MeV width, while the looser bounds apply to resonances of up to 20 MeV width. (auth)

7483 INELASTIC SCATTERING OF ELECTRONS ON HYDROGEN AND DEUTERIUM AT 1.2 GeV AND TRANSITION FORM FACTORS $\gamma p\Delta^+$ AND $\gamma n\Delta^0$. Akhmerov, R. V.; Omelaenko, A. S.; Stepula, E. V.; Titov, Yu. I. (Kharkov Physical Tech. Inst.). Yadern. Fiz.; 21: No. 1, 113-119(Jan 1975). (In Russian).

Pion electroproduction on deuterium and hydrogen is studied in the region of the excitation of the Δ^+_{1234} and Δ^0_{1234} isobars at 1.03 GeV and 1.21 GeV energies. The resonance cross sections on deuterium and hydrogen are observed. The transition form factors G^* of the vertices $\gamma^*n\Delta^0_{1234}$ and $\gamma^*p\Delta^+_{1234}$ are obtained in the k^2 range from 0.16 to 0.38 $(GeV/c)^2$. In this region the mean value $G^*_n/G^*_p = 1.02 \pm 0.08$, which is an evidence for nonexistence of the contribution from the isotensor component of the hadron electromagnetic current within the experimental errors. The value G^*_n/G^*_p shows that the upper limit of the isotensor component contribution to the magnetic dipole does not exceed 2%. (4 figures, 1 table) (auth)

7484 DOUBLE POSITRON-ELECTRON PAIR PRODUCTION, AN INTERACTION OF ELECTROMAGNETIC RADIATION WITH MATTER. Robertson, A. Hamilton, Ont.; McMaster Univ. (1974). vp. National Library of Canada, Ottawa.

Thesis (Ph. D.).

The task of detection and measurement of the instantaneous process of double positron-electron pair production was undertaken. Several targets of different atomic number were used, in conjunction with 6.6-MeV gamma rays, to isolate the process from the interfering two-pair processes known as the bremsstrahlung-cascade and the direct-cascade effects. A quantitatively significant value was determined for the cross section for double pair production relative to that for single pair production. (Diss. Abstr. Int., B)

Weak

7485 (ANL/HEP-75-08) STUDY OF NEUTRAL CURRENTS IN THE ARGONNE 12-FOOT BUBBLE CHAMBER. Hyman, L. G. (Argonne National Lab., Ill. (USA)). 1975. 23p. (CONF-750307-4). Dep. NTIS $4.25.

From international colloquium of the CNRS on neutrino physics at high energy; Paris, France (18 Mar 1975).

Using the ANL 12-foot H_2 bubble chamber filled with hydrogen and deuterium, neutral current events were isolated in the channels nu p yields nu p pi^0, nu p yields nu n pi^+, nu n yields nu p pi^- and nu n yields nu K^0/sub s/LAMBDA^0. The neutral current sample is compared to the corresponding charged current interactions. The background reactions which contributed to these channels were carefully studied, and it was concluded that the neutral current signal could be isolated. The Weinberg-Salam gauge model is in good agreement with the data. (auth)

7486 (COO-2114-21) ELEMENTARY PARTICLES AND HIGH ENERGY PHENOMENA. Progress Report, May 1974-April 1975. Nauenberg, U.; Bartlett, D. F. (Colorado Univ., Boulder (USA). Dept. of Physics and Astrophysics). May 1975. Contract E(11-1)-2114. 24p. Dep. NTIS $4.25.

The study of K^0/sub L/(pi^3) has now been published in final form. When compared with the matrix elements for the $K^+(pi^3)$, evidence was found for (I equals 1/2) violation in the linear terms, but not in the quadratic. The data-taking phase of a measurement of K^0/sub L/ yields K^0/sub S/ p and related reactions at SLAC were completed. The presence of neutrons in the beam permits one to study several new reactions. The apparatus for detecting tachyon monopoles was installed above the Fermilab 15' bubble chamber, and data-taking begun. No evidence yet found for these particles. The theoretical effort devoted to supporting the kaon experiments and to the study of dynamical symmetry breaking and Higg's symmetry. One has also written two proposals for experiments at Fermilab. A list of publications is included. (auth)

7487 (COO-3071-122) LIMIT ON THE PRODUCTION CROSS SECTION FOR MASSIVE LEPTONS. Bintinger, D.; Cheng, D.; Mann, A. K. (Pennsylvania Univ., Philadelphia (USA)). 1974. 13p. Dep. NTIS $4.00.

A search was made for heavy penetrating particles produced in nucleon-nucleon interactions. For the mass range 1 to 5 GeV/c^2 and transverse momenta from 1.0 to 2.25 GeV/c, it is concluded that the Lorentz invariant production cross section is less than 6.4×10^{-35} cm^2/GeV^2. Because of the compactness of the detector, this search is especially sensitive for heavy particle lifetimes of a few nanoseconds. (auth)

7488 (COO-3071-126) OBSERVATION OF NEW PARTICLE PRODUCTION BY HIGH ENERGY NEUTRINOS AND ANTINEUTRINOS. Benvenuti, A.; Cline, D.; Mann, A. K. (Pennsylvania Univ., Philadelphia (USA). Dept. of Physics). 1974. 12p. Dep. NTIS $4.00.

There were 14 events observed in which two muons are produced by high energy neutrino and antineutrino interactions. The absence of trimuon events and the observed characteristics of the dimuon events require the existence of one or more new, massive particles that decay through the weak interaction. The new particle mass is estimated to lie between 2 and 4 GeV. (auth)

7489 MEASUREMENTS OF THE CHARGE RATIO AND THE MOMENTUM SPECTRUM OF COSMIC-RAY MUONS AT LARGE ZENITH ANGLES IN RANGE (20 to 1000) GeV/c. Iida, S. (Nagoya Univ., Japan). Nuovo Cim., B; 26B: No. 2, 559-576(11 Apr 1975).

The charge ratio and the momentum spectrum of cosmic-ray muons at sea level were measured in the range of momenta from 20 to 1100 GeV/c and of zenith angles from 80 to 90° using the Nogaya Cosmic Ray Muon Spectrometer II. The maximum detectable momentum of this spectrometer is estimated to be 1200 GeV/c. About 500 muons with momenta higher than 500 GeV/c were observed in a total of 20,000 events. The charge ratio is found to be fairly constant at $1.23^{+0.07}_{-0.06}$ up to 1100 GeV/c. From the momentum spectrum it is concluded that the production spectra of pions and kaons can be expressed by a power of the momentum with an exponent of $-2.60^{+0.08}_{-0.07}$ and that the ratio of kaons to pions at production is less than 0.5. These results are in agreement with the predictions of the Feynman scaling law for primary collision energies up to 10 TeV. (auth)

7490 WEAK INTERACTION PHYSICS. Alitti, J.; Turlay, R. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physique des Particules Elementaires). Bull. Inf. Sci. Tech. (Paris).; No. 198, 79-94(Dec 1974). (In French).

Weak interactions study is essential in particle physics. A general outlook on the weak interactions theory, the trends of recent developments and their implications is given. The main results obtained at Saclay in the study of K decays both with counters and bubble chamber techniques, are presented and compared with theoretical predictions. The new possibilities in neutrino physics open by the 400 GeV accelerator in construction at CERN are presented. The experiments proposed by the DPhPE in collaboration with other European laboratories are described. (FR)

Strong (Baryon-induced)

Refer also to abstract 7801.

7491 (ANL/HEP-CP-75-18) p–p SCATTERING-AMPLITUDE MEASUREMENTS WITH POLARIZED BEAMS AND POLARIZED TARGETS AT 2 TO 6 GeV/c. Yokosawa, A. (Argonne National Lab., Ill. (USA)). 1975. 9p. (CONF-750309-2). Dep. NTIS $4.00.

From 10th moriond meeting; Meribel-les-Allures, France (2 Mar 1975).

First-stage scattering amplitude measurements on pp interactions at 2 to 6 GeV/c involving a relatively simple experimental setup, covering a small t region where one can accomplish a high precision measurement are discussed. Measurements thus far include differential cross sections and the polarization parameter. (JFP)

7492 (CEA-CONF-2991) EXPERIMENTS WITH 1 GeV PROTONS. Thirion, J. (CEA Centre d'Etudes Nucleaires de Saclay, 91- Gif-sur-Yvette(France). Dept. de Physique Nucleaire). 1974. 12p. (CONF-7409109-1). Dep. NTIS (US Sales Only) $4.00.

From international school of nuclear physics, the investigation of nuclear structure by scattering processes at high energies; Erice, Italy (30 Sep 1974).

Experiments with 1 GeV protons are reviewed briefly for elastic and inelastic scattering on various nuclei. (JFP)

7493 (CONF-741095-, pp 59-67) STUDIES OF MULTIBODY INTERACTIONS IN THE STREAMER CHAMBER AT ISR. Derado, I. (Max-Planck-Institut fuer Physick und Astrophysik, Munich). Oct 1974.

From proceedings of the triangle seminar; Beograd, Yugoslavia (28 Oct 1974).

In proceedings of the triangle seminar.

For the experiments discussed an attempt is made to be as exclusive as the machine allows to be able to study multibody interactions at the highest machine energy available. The studied pp interactions yield preliminary results on angular correlations between the charged particles and the observation of pp intersections with π^0 of large transverse momentum. (JFP)

7494 (CONF-741095-, pp 69-70) CHARACTERISTICS OF 200 AND 300 GeV PROTONS INTERACTIONS WITH EMULSION NUCLEI. Adamovic, O. (Inst. of Physics, Belgrade, Yugoslavia). Oct 1974.

From proceedings of the triangle seminar; Beograd, Yugoslavia (28 Oct 1974).

In proceedings of the triangle seminar.

The results from the conference on 200- and 300-GeV proton reactions with emulsion nuclei are that the inelastic cross sections and excitation energies do not depend on the energy of the incident proton. The mean multiplicity of shower particles is close to the corresponding number in pp interactions. The ratio $R = (n_{s_{em}}/n_{ch_{pp}}) \approx 1.7$ in 200- and 300-GeV proton reactions. In stars with $N_h = 0.1$ the angular distribution has a strong anisotropy in the cm system. More particles are emitted in the forward direction, probably because of the coherent production of π mesons. More particles emitted in the backward hemisphere in large stars indicate that secondary reactions are involved. (JFP)

7495 (COO-1545-158) MEASUREMENT OF THE POLARIZATION PARAMETER IN SMALL ANGLE PROTON–PROTON ELASTIC SCATTERING AT 6 GeV/c. Rust, D. R.; Crittenden, R. R.; Lesnik, A. (Ohio State Univ., Columbus (USA). Dept. of Physics). Apr 1975. Contract AT(11-1)-1545. 11p. Dep. NTIS (US Sales Only) $4.00.

The polarization parameters in pp elastic scattering was measured at 6 GeV/c with fine t resolution for $0.02 < -t < 0.5$ GeV^2 using a polarized proton beam with the Effective Mass Spectrometer at the Zero Gradient Synchrotron. The polarization rises like $\sqrt{-t}$ in the interval $0.02 < -t < 0.1$ GeV^2. No statistically significant structure was found in this region of momentum transfer. (auth)

7496 (IS-M-31(Rev.)) GAMMA-RAY MULTIPLICITY AND GAMMA-CHARGED PARTICLE CORRELATIONS IN 200 GeV/c pp INTERACTIONS. Anderson, E. W.; Crawley, H. B.; Kernan, W. J.; Ogino, F. (Argonne National Lab., Ill. (USA); Iowa State Univ. of Science and Technology, Ames (USA); Maryland Univ., College Park (USA); Michigan State Univ., East Lansing (USA); National Accelerator Lab., Batavia, Ill. (USA)). 17 Jun 1974. 9p. (CONF-740713-40). Dep. NTIS $4.00.

From 17th international conference on high-energy physics; London, UK (1 Jul 1974).

The reactions pp yields gamma-rays plus anything (charged) at 200 Gev/c in the NAL 30-inch bubble chamber-wide gap spark chamber hybrid system were studied. From a sample of 1234 inelastic bubble chamber events there were 2819 gamma-ray showers identified in the downstream spark chamber detector. Based on the shower data and charged tracks observed in the bubble chamber, one has determined the Mueller correlation parameters f_2^{00} and f_2^{-0}. The relation of these data to simple fragmentation and fluid model predictions is discussed. (auth)

7497 (IS-M-32) CHARGED PARTICLE CORRELATIONS IN 200 AND 300 GeV/c PP INTERACTIONS. Anderson, E. W.; Crawley, H. B.; Kernan, W. J.; Ogino, F. (Ames Lab., Iowa (USA)). 1974. 7p. (CONF-740713-41). Dep. NTIS $4.00.

From 17th international conference on high-energy physics; London, UK (1 Jul 1974).

Two particle correlation functions were studied in terms of C.M. rapidity and C.M. and laboratory pseudorapidity variables. The data presented, obtained with the NAL 30-inch bubble chamber-wide gap spark chamber hybrid system, together with previously published ISR data indicate that the rapidity density function evaluated in the central region, R(0,0), is essentially the same in terms of all variables studied and is energy independent. (auth)

7498 (JINR-1-7645) SOME METHODICAL PROBLEMS IN dp-EXPERIMENTS ON THE HYDROGEN BUBBLE CHAMBER OF THE JINR HIGH ENERGY LABORATORY. Aladashvili, B. S.; Badehlehk, B.; Glagolev, V. V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1973. 20p. (In Russian). INIS.

Specific methodical singularities in the processing of photographs in dp experiments on the JINR 100-cm hydrogen bubble chamber were indicated. Special attention was given to the determination of the cross section under conditions of small admixtures of protons in the beam. (tr-auth)

7499 (JINR-1-7825) INVESTIGATION INTO THE NP → NP$\pi^+\pi^-$ REACTION IN THE ENERGY RANGE 2 TO 10 GeV. Gasparyan, A. P.; Kopylova, D. K.; Nikitin, A. V.; Troyan, Yu. A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1974. 15p. (In Russian). INIS.

The reaction $np \to np\pi^+\pi^-$ was studied in the energy range from 2 to 10 GeV. The data reported did not contradict the OPE mechanism at energies up to 5 GeV. At high energies it is necessary to take into consideration the contribution of the diagram with exchange by Pomeranchuk poles and also the diagram of the multiperipheral type in which the formation of ρ^0 mesons is valid. An evaluation was made of the cross section for the formation of ρ^0 mesons at average momenta of the incident neutron of 6.6 and 9.1 GeV/c. The cross sections were 48 ± 16 and 150 ± 30 μb, respectively. (tr-auth)

7500 (JINR-P1-8666) HYPERON POLARIZATION IN π^-–p INTERACTIONS AT 5 GeV/c. Glagolev, V. V.; Kuznetsov, A. A.; Pestova, G. D.; Sabeu, M. (Joint Inst. for Nuclear Research,

Dubna (USSR)). 1975. 12p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The experimental results were presented on hyperon polarization ($\Lambda,\Sigma^-,\Sigma^+$) for inclusive processes of the type a + b → c + everything in π^-p interactions at P_{π^-} = 5 GeV/c. It is shown that for Λ-hyperon in the region 0 < t < 1.2 one can observe a similarity with the behavior of polarization in two- and quasi-two-body reactions. The change of the polarization sign may be explained by changing the slope in the differential cross section in these t regions. The difference of polarization from zero in the region of target fragmentation does not contradict previous theoretical predictions. The values of $\alpha\bar{P}$ calculated for Σ^-, Σ^+ are equal to

$$\alpha\bar{P}_{\Sigma^-} = 0.18 \pm 0.12,\ \alpha P_{\Sigma^+}\begin{cases}\Sigma^+ \to P\pi^0 = 0.78 \pm 0.27,\\ \Sigma^+ \to N\pi^+ = 0.18 \pm 0.23\end{cases}$$

(auth)

7501 (JINR-P10-8545) PROGRAMS OF KINEMATIC IDENTIFICATION OF SINGLE VERTEX EVENTS AND V^0 PARTICLES. Buzdavina, N. A.; Dorzh, L.; Zaikina, A. G.; Ivanov, V. G.; Lomakin, Yu. F.; Luk'yantsev, A. F.; Stepanenko, V. A. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 21p. (In Russian). Dep. NTIS (US Sales Only) $4.25.

The programs KINEML and AZA, as special versions of the program GRIND, are designed for kinematic identification of single-vertex events and V^0-particles using BESM-6. (auth)

7502 COMMENTS ON HIGH TRANSVERSE MOMENTUM PHYSICS. Lederman, L. M. (Columbia Univ., NY). Comments Nucl. Particle Phys.; 6: No. 2, 41-45(Apr 1974).

It is stated that the development of Intersecting Storage Rings at CERN was a bold gamble of European physics in so far as it was thought that extremely high energy would "pay-off." Early experimental work tended to give detailed but discouraging results. Physics at high energies seemed to be remarkably the same as with lower energy accelerators. With improved accelerator characteristics and more speculative experimental programs, however, this situation changed. A new phenomenon was discovered—a "break" in the steep exponential fall-off of cross section with P_T, the transverse momentum of single particles emitted in ISR pp collisions. This is discussed, including a brief survey of relevant theoretical papers. Amongst other things the ISR experiments appeared to indicate the reality of partons. Future work is suggested. (10 references) (UK)

7503 EXPERIMENTS AT CERN STORAGE RINGS. Zylberstejn, A. (CEA Centre d'Etudes Nucleaires de Saclay, 91 – Gif-sur-Yvette (France). Dept. de Physique des Particules Elementaires). Bull. Inf. Sci. Tech. (Paris).; No. 198, 55-62(Dec 1974). (In French).

The CERN storage rings allow the study of high energy proton-proton collisions. The Saclay Elementary Particle Department is involved in experiments studying the production of particles at 90 deg in the center of mass. New phenomena were observed which cannot be entirely described by theoretical models of strong interactions. (auth)

7504 INVESTIGATION OF HIGH ENERGY STRONG INTERACTIONS IN BUBBLE CHAMBERS. Barloutaud, R.; Pauli, E. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physique des Particules Elementaires). Bull. Inf. Sci. Tech. (Paris).; No. 198, 31-43(Dec 1974). (In French).

The high energy bubble chamber experiments are devoted to the K^-p interaction at 14.3 GeV/c, K^+ and K^-p at 32 GeV/c and pp at 69 GeV/c. The pictures are taken in the 2 meters bubble chamber at CERN and in the 4.5 meters, Mirabelle, at Serpukhov. The reactions which are studied are on one hand, two body or quasi-two-body reactions, and on the other hand, the multibody reactions. The first ones are dominated by diffractive processes in which one of the incident particle remains in its initial state while the other one is fragmented into a few particles. The second kind of reactions, whose contribution increases with energy, are studied by means of the momentum distributions of a single well defined particle; these distributions are compared to the theoretical scaling predictions. (FR)

7505 COMPARISON OF THREE-PRONG STARS PRODUCED IN NUCLEAR EMULSION BY PROTONS WITH MOMENTA OF 21 AND 200 GeV/c. Abduzhamilov, Sh.; Azimov, S. A.; Askarkhodzhaeva, Kh. M.; Dzhuraev, M.; Chudakov, V. M. (Physical-Tech. Inst., Kazan). Yadern. Fiz.; 21: No. 1, 147-153(Jan 1975). (In Russian).

Cross sections of the coherent reactions and the angular correlations are compared for three-prong events produced in nuclear emulsion at two values of the incident proton momentum: 21 and 200 GeV/c. By means of the correlation analysis an inhomogeneity of the three-prong pn collisions at 200 GeV/c is detected that is interpreted in view of an increase of cross section of the diffractive excitation of one of the colliding nucleons. (2 tables, 1 figure) (auth)

7506 MECHANISM OF Δ_{1236} DOUBLE PRODUCTION IN THE REACTION np → np$\pi^+\pi^-$ IN THE ENERGY RANGE 2 TO 10 GeV. Gasparyan, A. P.; Kopylova, D. K.; Nikitin, A. V.; Troyan, Yu. A. (Joint Inst. for Nuclear Research, Dubna, USSR). Yadern. Fiz.; 21: No. 1, 133-138(Jan 1975). (In Russian).

The mechanism of production of a double isobar Δ_{1236} in the reaction np → np$\pi^+\pi^-$ is considered in detail for 2–10 GeV energy range. The existence of the exotic exchange for Δ^{++} production is due to the kinematical reflection of the process of production and subsequent decay of heavy isobars with masses from 1500 to 1700 MeV/c^2 into Δ^{++} and π^-. (10 figures, 2 tables) (auth)

7507 MULTIPLICITY DISTRIBUTION IN PROTON–NUCLEUS COLLISIONS AT 200 AND 300 GeV. Jain, P. L.; Kazuno, M.; Thomas, G.; Girard, B. (State Univ. of New York, Buffalo). Lett. Nuovo Cim.; 12: No. 17, 653-658(26 Apr 1975).

In order to see how the shower particle multiplicities produced from different targets of emulsion nuclei change as a function of energy, observed events are separated into four categories: hydrogenlike events, light elements, heavy elements, and average emulsion nuclei. The results indicate a weak dependence of n_s on mass number and a linear relation with log E_ν. The asymmetry, the dispersion, the correlation parameters in proton reaction behave in the same way as in p–p interactions. (JFP)

7508 PRODUCTION OF CHARGED PARTICLES IN THE HADRON–NUCLEUS INTERACTIONS AT VERY HIGH ENERGIES. Kohli, J. M. (Panjab Univ., Chandigarh, India). Lett. Nuovo Cim.; 13: No. 1, 19-25(3 May 1975).

An attempt is made to compile various high energy multiplicity measurements in nuclear emulsions, separating the collisions in light nuclei from those on heavy nuclei. The experimental results are based on the interactions of protons and pions with energies ranging between few GeV to the cosmic ray energies. (JFP)

7509 PARTICLE MULTIPLICITIES IN 28 GeV/c pNe COLLISIONS. Miller, D. J.; Nowak, R. (Univ. Coll., London). Lett. Nuovo Cim.; 13: No. 1, 39-43(3 May 1975).

Results are reported from a partial scan of neon and hydrogen filled bubble chamber film exposed to 28-GeV/c protons. Track correlations, average multiplicities, and unambiguous gamma rays are discussed. (JFP)

Strong (Meson-induced)

Refer also to abstract 6558.

7510 (CERN/HERA-75-2) COMPILATION OF DIFFERENTIAL CROSS SECTIONS π-INDUCED REACTIONS. Bracci, E.; Burichetti, C.; Droulez, J. P.; Flaminio, E.; Preti, C. (European Organization for Nuclear Research, Geneva (Switzerland)). 28 Feb 28 Feb 1975. 343p. Dep. NTIS (US Sales Only) $20.25.

A compilation of differential cross sections for two-body and quasi-two-body reactions induced by π^- and for elastic π^+ interactions is presented. Graphs of $d\sigma/dt$ and $d\sigma/du$ for such reactions are given. (auth)

7511 (CONF-741095-, pp 31-40) INTERFERENCE BETWEEN DIFFRACTIVE DISSOCIATION AND RESONANCE PRODUCTION. Mac Naughton, J. N. (Akademie der Wissenschaften, Vienna). Oct 1974.

From proceedings of the triangle seminar; Beograd, Yugoslavia (28 Oct 1974).

In proceedings of the triangle seminar.

Overlap between diffractive dissociation and resonance production at these energies were observed for the reactions $\pi^+ p \to \pi^+ p\pi^0$. Interference between ρ^+ production and proton dissociation and between Δ^{++} production and K^- dissociation (Q^- production) respectively were observed. (JFP)

7512 (FERMILAB-74/110-THY) SOME CONSIDERATIONS ON ETA_C. Lee, B. W.; Quigg, C. (Fermi National Accelerator Lab., Batavia, Ill. (USA)). Dec 1974. 4p. Dep. NTIS $4.00.

The mass, decay modes and widths, and the production of a cc bound state of J/sup PC/ equals 0/sup −+/ are briefly discussed. (JFP)

7513 (JINR-E1-8694) BACKWARD PROTON EMISSION FROM THE REACTION π^+ + Xe at 2.34 GeV/c. Slovinskii, B.; Strugal'skii, Z.; Srednyava, B. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 21p. Dep. NTIS (U. S. Sales Only) $4.25.

The results of investigation of the angular and energy distributions of protons from the reaction π^+ + Xe at 2.34 GeV/c, in which

no more than four charged secondary particles are observed. The observed distributions do not depend on the number of registered secondary particles and confirm the assumption of a considerable clusterization of xenon nuclear surface. The dependence of the Lorentz invariant cross section for proton emission in the investigated reaction deviates from the exponential dependence in the kinetic energy region $E_k \lesssim 60$ MeV. (auth)

7514 (JINR-P1-8699) FOUR-PRONG π^-p INTERACTIONS WITH π^0 PRODUCTION AT 5 GeV/c. 1. Experimental Procedure; Cross Section Determination By Kinematical Identification of Events. Amaglobeli, N. S.; Budagov, Yu. A.; Vinogradov, V. B. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 17p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The experimental procedure for studying $\pi^-p \to p\pi^+\pi^-\pi^- + m\pi^0$ and $\pi^-p \to n\pi^+\pi^+\pi^-\pi^- + m\pi^0 (m \geq 1)$ processes at 5 GeV/c with a one-meter propane bubble chamber, the method and the results of partial cross section determination for the mentioned processes by kinematical identification of events are reported. (auth)

7515 (JINR-P1-8702) INTERACTION CROSS SECTIONS FOR UNSTABLE PARTICLES FROM THE DATA ON π^-C-COLLISIONS AT 5 GeV. Amaglobeli, N. S.; Budagov, Yu. A.; Vinogradov, V. B. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 12p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The estimates were given for cross section of interactions of A_1 (1100), ρ(780) and Δ_{33}^{--}(1236) with intranuclear nucleons. The estimates were obtained from the data on $(3\pi)^-$-system production on C nuclei at 5 GeV $\sigma_{\rho^-N} = (24^{+7}_{-6})$ mb, $\sigma_{A_1^-N} = (48^{+7}_{-6})$ mb and $\sigma_{\Delta^-N} = (75^{+7}_{-6})$ mb. The investigation was performed at the Laboratory of Nuclear Problems, JINR. (auth)

7516 POLARIZED TARGET EXPERIMENTS. Ducros, Y. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physique des Particules Elementaires). Bull. Inf. Sci. Tech. (Paris).; No. 198, 45-53(Dec 1974). (In French).

The use of polarized proton target has been developed to study elementary particle reactions. After a brief survey of technical developments, the experiments realized at CERN and Serpukhov on polarization phenomena in elastic and charge exchange reactions above 6 GeV are described. (FR)

7517 HADRON SPECTROSCOPY. Bareyre, P.; Dolbeau, J.; Laurens, G.; Lesquoy, E.; Prevost, J.; Tallini, B. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physique des Particules Elementaires). Bull. Inf. Sci. Tech. (Paris).; No. 198, 11-29(Dec 1974). (In French).

The contributions of the Saclay Elementary Particle Department to hadron spectroscopy, i.e., to the study of baryonic resonances of strangeness 0, +1 and −1 as well as the study of pion-pion resonances are reviewed. The energy range, presently called low energy, extends to 2500 MeV. The parameters of the resonances and their quantum numbers are established through partial wave analyses. The aim is to contribute to the elaboration of classification schemes in the frame of unitary symmetries. (FR)

7518 MULTIPLICITY OF π^0 MESONS IN π^-p INTERACTIONS AT 40 GeV/c. Gerdyukov, L. N.; Kuznetsov, E. P.; Manyukov, B. A.; Parshikura, S. N.; Shlyapnikov, P. V. (Inst. of High Energy Physics, Serpukhov, USSR). Yadern. Fiz.; 21: No. 1, 147-149(Jan 1975). (In Russian).

It is shown that the multiplicity distribution of the secondary π^0 mesons produced in π^-p interactions at 40 GeV/c is described by means of the Poisson distribution similar to that for pairs of the secondary charged particles. In the multiplicity distributions of all the secondary particles no two-bump structure is detected, though there are some indications to an existence of a shoulder at low multiplicities. (2 fig., 1 table) (auth)

7519 ANALYSIS OF THE π^-p INTERACTIONS IN THE TARGET MASS AT p = 40 GeV/c AND SEPARATION OF THE DIFFRACTION COMPONENT. Budapest-Bucharest-Warsaw-Dubna-Cracow-Moscow-Sofia-Tashkent-Tbilisi-Ulan-Bator-Hanoi. Collaboration. Yadern. Fiz.; 21: No. 1, 139-146(Jan 1975). (In Russian).

The purpose of the work is to separate the diffraction component in the π^-p interactions at the momentum p = 40 GeV/c in reactions of the type $\pi^-p \to p+\ldots$, where the proton has a momentum p < 800 MeV/c. Events of diffractive dissociation of the incident pion were separated using the criteria of the target effective mass M_t and the missing mass squared (MM^2). Topological cross sections of the diffraction events for the interval $MM^2 < 20$ GeV^2 and $\widetilde{M}_t < 150$ MeV are determined. The total diffractive dissociation cross section for the π^- meson is found to be $\sigma_D = 2.32 \pm 0.12$ mb. Average multiplicity of the secondary charged particles in such events is $\langle n_4 \rangle = 3.47 \pm 0.17$. The four-momentum transfer distribution was fitted by means of the exponent exp(a|t|), with the slope $a = -10.9 \pm 0.9$ GeV^{-2} for $|t| < 0.3$ GeV^2. (8 figures, 1 table) (auth)

Particle Interactions and Properties (Theoretical)

General

Refer also to abstract 7479.

7520 (CNEN-LNF-74-25(P)) HARMONIC INVERSION AND RECIPROCITY RELATIONS OF DEEP INELASTIC STRUCTURE FUNCTIONS. Caiazza, G. C. (Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Laboratori Nazionali di Frascati). 10 May 1974. 8p. INIS.

A new derivation is given of the reciprocity relations between deep inelastic structure functions based on a representation of the transformation by reciprocal radii as an integral transform in the space of harmonic functions. A simple picture, consistent with the intuition of short-distance operator product expansions, is suggested. (auth)

7521 (CONF-7306115-P1, pp C.XI1-C.XI6) ELKIN, A COMPUTER PROGRAM FOR KINEMATIC CALCULATIONS OF INTERACTIONS AMONG ARBITRARY NUMBER OF PARTICLES WITH ARBITRARY SPIN. Frick, I. (Univ. of Stockholm). 1973.

From 3rd international colloquium on advanced computing methods in theoretical physics; Marseille, France (25 Jun 1973).

In third international colloquium on advanced computing methods in theoretical physics, Marseille, June 25–29, 1973. (Centre National de la Recherche Scientifique, 13 - Marseille (France). Centre de Physique Theorique).

ELKIN is based on a method of kinematic analysis that uses invariant amplitudes with two invariant indices for each particle. Differential cross sections can be calculated, expressed in invariant amplitudes and particle momenta. Conservation laws can be applied, reducing the number of amplitudes. ELKIN is written in LISP and the assembler language LAP. The simplification part of the program is an adaption of the function SIMP from the algebraic language LAM. (auth)

7522 (CONF-7306115-P2) THIRD INTERNATIONAL COLLOQUIUM ON ADVANCED COMPUTING METHODS IN THEORETICAL PHYSICS, MARSEILLE, JUNE 25–29, 1973. Visconti, A. (ed.). (Centre National de la Recherche Scientifique, 13 - Marseille (France). Centre de Physique Theorique). 1973. vp.

From 3rd international colloquium on advanced computing methods in theoretical physics; Marseille, France (25 Jun 1973).

Separate abstracts were prepared for 3 papers. Other papers were outside the subject scope of NSA. (JFP)

For abstracts of individual papers see: 7391, 7574, and 7617.

7523 (CONF-741095-) PROCEEDINGS OF THE TRIANGLE SEMINAR, BEOGRAD, 28–29 OCTOBER 1974. Juric, M. (ed.). (Belgrade Univ. (Yugoslavia)). Oct 1974. 92p.

From proceedings of the triangle seminar; Beograd, Yugoslavia (28 Oct 1974).

Separate abstracts were prepared for the nine papers presented. (JFP)

For abstracts of individual papers see: 7493, 7494, 7511, 7567, 7568, 7590, 7605, 7618, and 7801.

7524 (COO-1545-157) FERMION NUMBER IN SUPERSYMMETRIC MODELS. Mainland, G. B.; Tanaka, K. (Ohio State Univ., Columbus (USA). Dept. of Physics). 1975. Contract E(11-1)-1545. 12p. Dep. NTIS $4.00.

The two known methods for introducing a conserved fermion number into supersymmetric models are discussed. While the introduction of a conserved fermion number often requires that the Lagrangian be massless or that bosons carry fermion number, A model is discussed in which masses can be introduced via spontaneous symmetry breaking and fermion number is conserved at all stages without assigning fermion number to bosons. (auth)

7525 (HU-TFT-74-11) SEMI-INCLUSIVE RAPIDITY DISTRIBUTIONS IN A CLUSTER EMISSION MODEL FOR THE PIONIZATION COMPONENT. Sohlo, S. (Helsinki Univ. (Finland). Research Inst. for Theoretical Physics). 1974. 13p. INIS.

A cluster model for the pionization component to semi-inclusive distributions is applied, and predictions of this model are compared with NAL and ISR data for both one- and two-particle semi-inclusive distributions. The comparison with data is justified for charged multiplicity $n \geq \langle n \rangle$. Simultaneous fitting of both one- and two-particle semi-inclusive densities is found to be a severe test for models and data. (auth)

7526 (INIS-mf-1621) RECENT RESEARCH PROBLEM IN THE ELEMENTARY PARTICLE THEORY. A Study of Some

Models in the Quantum Field Theory. Ulău, F. S. (Cranfield Inst. of Tech., Bedford (UK)). 1973. 34p. (In Romanian). INIS. Thesis.

The main aspects of the Lee model are discussed together with a model with separable potential. The two models are treated independently, but still a parallel between the two is in permanent view. The Lehman-Symanzik-Zimmermann method regarding the axiomatic theory of the fields was used in the study of the Lee model. The results already known from the inferior section studies were generalized for the cases involving the upper sections having the following structure: (1,n), (n,1), (n_2,2), (n,3) and in the end, they were also generalized for the general section (n,k) with a completely arbitrary n and k. The study of a model with separable potential (related to Lee model) is also presented on account of the LSZ method. In particular, the sections including one or two light-particles were studied in detail, and the correspondence between this model and the Lee model was also pointed out, in the $Z_3 = 0$ limit. (auth)

7527 (JINR-E2-8542) TAUBERIAN THEOREMS AND INCLUSIVE PROCESSES. Berceanu, S. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 13p. Dep. NTIS (US Sales Only) $4.00.

It is argued that diffractive processes cannot lead to the saturation of the kinematical bound of the average multiplicity. If the structure functions for inclusive reactions have scaling upper bounds and verify some general conditions at large transverse momentum in the central region, then the unsaturation of the kinematical bound of $\langle p_\perp \rangle$ and $\langle n \rangle$ occurs. It is shown also that if $\langle p_\perp \rangle$ and $\langle n \rangle$ increase asymptotically slower than $\sqrt{s}$, then a left–right conservation of reduced c.m. longitudinal momentum follows. (auth)

7528 (JINR-E2-8544) CLASSIFICATION OF MODEL PREDICTIONS ON ASYMPTOTIC BEHAVIOR OF MULTIPLICITY MOMENTS. Berceanu, S. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 12p. Dep. NTIS (US Sales Only) $4.00.

A method to classify the behavior of average multiplicity and higher moments at high energy is presented. Supposing various unbounded asymptotical behaviors for the generating multiplicity function, predictions of different models on average multiplicity can be reproduced. (auth)

7529 (JINR-E2-8594) DYNAMICS OF CONSTITUENT AND CURRENT QUARKS. Kobushkin, A. P.; Shelest, V. P. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 13p. Dep. NTIS (U. S. Sales Only) $4.00.

The relativistic equations for bound states of three quarks in the "constituent" and "current" representations which, in turn, make it possible to calculate the transformation between "constituent" and "current" representations for interacting quarks. (auth)

7530 PHENOMENOLOGISTS AND THEIR PHENOMENA. High Energy Physics File 3. Michael, C. (Liverpool Univ.). New Sci.; 65: No. 942, 794-797(27 Mar 1975).

The role of the phenomenologist, as a communicator between the theorist and the experimenter, is explained. The nature of strong interactions, on which the main weight or phenomenology bears, is discussed. The phenomenological model of the proton, which resulted from experiments in which strongly interacting particles were bombarded with beams of other strongly interacting particles, described the proton as made of three valence partons, a sea of parton/anti-parton pairs and some additional neutral component thought of as glue (gluons). Phenomenological concepts derived from hadron/hadron collisions including the quark model, the Regge pole, and, for elastic two-body scattering, the Pomeron are considered. The analysis of multiple particle production and the discovery of high transverse momentum events are discussed in the light of recent experimental work at the CERN ISR. (UK)

7531 STATISTICAL PHYSICS, PARTICLE MASSES, AND THE COSMOLOGICAL COINCIDENCES. Lawrence, J. K.; Szamosi, G. (California State Univ., Fullerton). Nature (London); 252: No. 5484, 538-539(13 Dec 1974).

The theme is that a new look at some familiar "cosmological coincidences" may provide a means of predicting mass values for elementary particles. Examples include the approximate equality of such large dimensionless numbers as the ratio of the electromagnetic to the gravitational interaction strengths of particles, the ratio of the size of the universe to the size of an elementary particle, and the square root of the number of particles in the universe. There has been controversy not only concerning the possible meaning of these "coincidences", but also over the existence of any meaning at all. It is shown using simple assumptions about the nature of the physical parameters and of the universe, that the "coincidences" may be derived in a logically coherent way, which also yields a reasonable limit for the mass of an elementary particle in terms of fundamental constants. It can also lead to an expression for the fundamental electric charge. (UK)

7532 DESCRIPTION OF CHARGED- AND NEUTRAL-MULTIPLICITY DISTRIBUTIONS. Schlesinger, J. (Univ., Mons, Belgium). Lett. Nuovo Cim.; 12: No. 13, 487-491(29 Mar 1975).

It is shown that characteristics of both charged and neutral multiplicity distributions above 50 GeV/c are well reproduced by a compound Poisson distribution (CPD). Experimental and CPD values of the average of neutral-charged moments in the 69-103 GeV/c interval are presented in tabular form. (2 figures, 1 table) (SDF)

7533 ELEMENTARY PARTICLE THEORY IN SIX-DIMENSIONAL SPACE WITH A CURVATURE AND DISCRETE OPERATORS. Leble, S. B. Vestn. Leningrad. Univ., Fiz., Khim.; 22: No. 4, 74-81(Nov 1974). (In Russian).

Space-time reflection operators were built in the elementary particle theory model based on the analysis of six-dimensional space with a curvature. These operators are chosen from the set of representatives of those generating external automorphisms of the group of motions of plane six-dimensional space (local group). (auth)

7534 REPLY TO LEITER'S CRITICISM OF A NEW THEORY OF ELEMENTARY MATTER. Sachs, M. (State Univ. of New York, Buffalo). Int. J. Theor. Phys.; 10: No. 5, 317-319(Sep 1974).

Reference is made to a claim by Leiter (Int. J. Theor. Phys.; 7: 199 (1973)) that he had found an error in the present author's formulation of a new theory of elementary matter (Sachs. Int. J. Theor. Phys.; 4: 433 and 453 (1971), 5: 35 and 161 (1972)). This was in regard to its application to electrodynamics in the quantum domain. It was asserted that the formal structure suggested cannot incorporate the Pauli exclusion principle and from this it was concluded that the theory must be false. Leiter's comments are rebutted, the set of technical errors that he makes in the criticism being indicated. (UK)

7535 REST MASS QUANTISATION OF ELEMENTARY PARTICLES AND POSSIBLE EXISTENCE OF HITHERTO UNKNOWN PARTICLES. Chacko, T. (Mar Athanasius Coll. of Engineering, Kerala, India). Int. J. Theor. Phys.; 11: No. 1, 1-4(Oct 1974).

A general mass formula, based on the principle of quantization of rest mass, gives accurate mass ratios for many of the known elementary particles, predicting the muon mass to within 1 part in 10,000 of the experimental value and indicates the possibility for the existence of a number of particles which have not yet been identified experimentally. (auth)

7536 S-CHANNEL FORMULATION OF THE EXCHANGE DEGENERATION HYPOTHESIS. Mandzhavidze, I. D. (Inst. of Physics, Tbilisi, USSR). Yadern. Fiz.; 21: No. 1, 182-192(Jan 1975). (In Russian).

Based on such general principles as charge conservation and unitarity, an attempt is made to obtain restrictions on parameters used in reggeon description of the inclusive cross sections. Equations relating semi-inclusive cross sections for production of particles of a certain type to the inclusive cross sections are used. (auth)

7537 HIGH ENERGY PHYSICS INDEX. Volume 13, No. 4, 1975. Leopoldshafen, Ger.; Zentralstelle fuer Atomkernenergie-Dokumentation (1975). 97p.

7538 HIGH ENERGY PHYSICS INDEX. Volume 13, No. 5, 1975. Leopoldshafen, Ger.; Zentralstelle fuer Atomkernenergie-Dokumentation (1975). 96p.

7539 PHENOMENOLOGICAL MODEL FOR DIFFRACTION AND INCLUSIVE REACTIONS. Kuroda, M. (Tokyo Univ.). Lett. Nuovo Cim.; 13: No. 1, 29-33(3 May 1975).

A phenomenological model for high energy diffraction is applied to inclusive reactions, and the physical consequences of this model are investigated. It is seen that this model reproduces most of the properties of the inclusive reactions such as scaling, factorization, etc., obtained within the framework of the Regge-pole phenomenology. With the use of the resonance saturation model, the diffractive excitation form factors are connected with the triple-pomeron coupling. Also the decoupling of the triple-pomeron coupling at t = 0 is seen. (JFP)

Electromagnetic

Refer also to abstracts 7388, 7691, 7756, 7928, 7930, and 7969.

7540 (CONF-7306115-P1, pp C.III1-C.III19) CALCULATION OF SIXTH ORDER RADIATIVE CORRECTIONS TO THE ELECTRON MAGNETIC MOMENT. Kinoshita, T. (Cornell Univ., Ithaca, NY). 1973.

From 3rd international colloquium on advanced computing methods in theoretical physics; Marseille, France (25 Jun 1973).

In third international colloquium on advanced computing methods in theoretical physics, Marseille, June 25–29, 1973. (Centre National de la Recherche Scientifique, 13 - Marseille (France). Centre de Physique Theorique).

The method used to calculate the contribution to the electron magnetic moment from a class of sixth order vertex diagrams which has no closed electron loop is described in some detail. Included are the economic parametrization of Feynman integrals, a new approach to the renormalization of ultraviolet divergences and the separation of infrared divergent parts of Feynman integrals, and the application of Ward–Takahashi identity for simplification of magnetic moment calculation. (JFP)

7541 (CONF-7306115-P1, pp C.VI1-C.VI12) NEW DISPERSIVE TECHNIQUE FOR THE (g – 2). Remiddi, E. (CNRS, Marseille). 1973.

From 3rd international colloquium on advanced computing methods in theoretical physics; Marseille, France (25 Jun 1973).

In third international colloquium on advanced computing methods in theoretical physics, Marseille, June 25–29, 1973. (Centre National de la Recherche Scientifique, 13 - Marseille (France). Centre de Physique Theorique).

The results obtained by means of dispersion relations in the evaluation of the 6th order (g-2) of leptons, the difficulties encountered and the new technique which is being developed to overcome them. (JFP)

7542 (CONF-7306115-P1, pp C.VII0-C.VII12) SHORT-DISTANCE BEHAVIOR OF THE PHOTON–PROPAGATOR. de Rafael, E. (Institut des Hautes Etudes Scientifiques, Bures-sur-Yvette, France). 1973.

From 3rd international colloquium on advanced computing methods in theoretical physics; Marseille, France (25 Jun 1973).

In third international colloquium on advanced computing methods in theoretical physics, Marseille, June 25–29, 1973. (Centre National de la Recherche Scientifique, 13 - Marseille (France). Centre de Physique Theorique).

The calculation for the short distance behavior of the photon propagator is described as calculations in search of simplicity. It is desired to calculate exactly as few low order terms in perturbation theory of some functions which are believed to be fundamental. It is to be determined whether in the process of the actual calculations one can learn or can guess some general patterns. A summary is given of what has been calculated thus far, and the future direction of the calculations is explained. (JFP)

7543 (DESY-75/06) SCALING OF $\sigma_{e^+e^- \to \text{hadrons}}$ IN ASYMPTOTICALLY NONFREE THEORIES. Gutbrod, F.; Kerler, W. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (F. R. Germany)). Mar 1975. 26p. Dep. NTIS (US Sales Only) $4.50.

The $\sigma_{e^+e^- \to \text{hadrons}}$ is calculated from the Dyson form of the photon self-energy. For the vertex of the elementary constituents the Nakanishi representation is used. A regularization scheme for the Nakanishi spectral function is taken from perturbation theoretic considerations. With simple assumptions about the spectral function, the renormalizability of the theory leads to the asymptotic form $\sigma_{e^+e^- \to \text{hadrons}} \sim \text{const}/s$. The constant depends on the anomalous dimension of the propagator. The transition to the asymptotic region occurs rather slowly. No jets are expected in the final state and the elementary constituents need not appear in the final state to an appreciable fraction. (auth)

7544 (DESY-75/09) COMMENT CONCERNING THE EVALUATION OF THE CABIBBO–RADICATI SUM RULE. Genz, H. (Deutsches Elektronen–Synchrotron (DESY), Hamburg (F. R. Germany)). Apr 1975. 16p. Dep. NTIS (US Sales Only) $4.00.

The Gilman–Schnitzer-evaluation of the Cabibbo–Radicati sum rule is discussed. It is argued that the SU(2)-generalization of the $\Delta N\pi\gamma$-contact term has to be included in the evaluation. Doing so considerably decreases (15% rather than 8% discrepancy) the agreement of the sum rule with the data. (auth)

7545 (EUR-5170e) PROPAGATION OF COHERENT ELECTROMAGNETIC RADIATION IN THE ATMOSPHERE. Blaesser, G. (Commission of the European Communities, Ispra (Italy). Joint Nuclear Research Center). 1974. 50p. Dep. NTIS (US Sales Only) $5.50. EUR B.Fr. 70.-.

A summary of the present state of knowledge concerning the propagation of visible, infrared and microwave radiation in the atmosphere is given. After an introduction to the general characteristics of the three main wave fields, i.e. plane waves, spherical waves, and Gaussian beams, and an outline of the main features of the scattering by impurities (aerosols etc.), the main concern is with the effects of the stochastic fluctuations of the index of refraction which are caused by atmospheric turbulence, and which are responsible for amplitude and phase fluctuations in communication links, for losses in coherence, for scattering or even "beam steering" (deviation of the path of the whole beam). (auth)

7546 (IC-74-41) $e^+e^- \to$ HADRONS VIA FERMI INTERACTIONS. Budini, P. (International Centre for Theoretical Physics, Trieste (Italy)). May 1974. 8p. INIS.

In the frame of a model of finite lepton quantum electrodynamics in which regularization originates from the Fermi lepton Lagrangian previously presented, an explanation of the recent $e^+e^- \to$ hadrons experiments is proposed as evidence of the finite size G_F^{γ} of the photon and of the strong lepton-hadron interactions via the Fermi Lagrangian. (auth)

7547 (JINR-P2-8655) COMPTON-EFFECT ON KAON. Volkov, M. K.; Pervushin, V. N. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 13p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

In the framework of the quantum chiral theory the amplitude was calculated for the Compton effect on kaon. The estimate of the value of the kaon polarizability was obtained to be $a_{K^\pm} = 1.6 \cdot 10^{-3}$ f^3, $a_{K^0} = 0$. (auth)

7548 (N-74-26180) DIFFUSIVE IDEALIZATION OF CHARGED PARTICLE TRANSPORT IN RANDOM MAGNETIC FIELDS. Earl, J. A. (Maryland Univ., College Park (USA)). Apr 1974. 33p. (NASA-CR-138510; TR-74-078). NTIS $4.75.

The transport of charged particles diffusing in a random magnetic field parallel to a relatively large guiding field is presented. The same coefficient of diffusion is obtained by three methods. Two corrections must be added to the expression in which the diffusive flux is proportional to the gradient of the density. Explicit expressions are given for a characteristic time and a characteristic length which describe the corrections. The well known divergence of the coefficient of diffusion, which is implied by the quasilinear analysis of pitch angle scattering, does not occur if the scattering rate is finite at 90 deg pitch angle. This effect is illustrated by formulas which give the coefficient of diffusion when the quasilinear expression is perturbed by a variable amount of isotropic scattering. (STAR)

7549 (ORO-3992-213) LEPTON G-2 IN A DUAL GAUGE MODEL. Dicus, D. A. (Texas Univ., Austin (USA). Center for Particle Theory). 1974. Contract AT(40-1)-3992. 10p. (CPT-258). Dep. NTIS $4.00.

An estimate is given for the decay rate of the neutral pion into three photons by using a single quark loop in a model with parity violation. (auth)

7550 SCATTERING OF ELECTROMAGNETIC RADIATION BY A FREE ELECTRON. Dodd, J. N. (Otago Univ., Dunedin, New Zealand). J. Phys., B (London); 8: No. 2, 157-164(1 Feb 1975).

It is shown that the frequency of the scattered radiation can be deduced accurately using a model in which the radiation is described as a classical electromagnetic wave. By considering the experimental facts and applying the conservation laws, the quantal nature of the interaction is exposed. The view is taken that this resides in the charge-matter system, but not in the electromagnetic radiation. (auth)

7551 IMPORTANCE FOR THEORY AND EXPERIMENTAL METHODS OF RESEARCH INTO FAST ELECTRON FIELD. Horak, Z.; Novak, R. (Czech. Technical Univ., Prague). Elektrotech. Obz.; 62: No. 12, 705-711(Dec 1973). (In Czech).

Well known formulas issuing from classical and relativistic electrodynamics for the electromagnetic field of fast charged particles were not yet verified by direct measurement with sufficient accuracy. Neither were deviations from the Biot-Savart law established for electron beams accelerated to an energy of up to 30 MeV. The importance is stressed for theory of determining the deviations. Original experiments are described confirming that the field of fast electrons differs from the Biot-Savart field, this in agreement with theory. The experiments can be regarded as the first experimental ascertainment of the existence of a relativistic effect of the 4th order. (7 figures) (Nucl. Sci. Abstr. Czech.)

7552 DIPOLE ELECTROMAGNETIC RADIATION IN A SCHWARZSCHILD SPACE: THE WAVETAIL TO ORDER m/r. Papapetrou, A. (Univ., Paris). J. Phys., A (London); 8: No. 3, 313-327(Mar 1975).

Maxwell's equations are considered in a Schwarzschild space,

and the retarded solution is determined to order m^2/r^2 of an electric dipole located at the center of symmetry. The dipole moment p(t) is assumed to be variable in the interval $t_1 \leq t \leq t_2$ and to have the constant values p_1 for $t < t_1$ and p_2 for $t > t_2$. It is found that for $t \to \infty$ the field tends asymptotically to the static field corresponding to a constant dipole p_2 even in the case $p_2 \neq p_1$. This is due to the fact that the Newman-Penrose conservation laws are valid only in some region of the space-time adjacent to future null-infinity. The formulas for the wavetail (in the region $u > t_2$) to order m/r are discussed in some detail. (auth)

7553 CLASS OF INTEGRAL CONSERVATION LAWS IN CURVED SPACE–TIME. Villarroel, D. (Univ., Chile, Santiago). Lett. Nuovo Cim.; 12: No. 15, 581-585(12 Apr 1975).

A class of integral conservation laws related with the electromagnetic field of an arbitrarily moving electron in a curved space is discussed. These integral laws arise from a corresponding differential conservation law. They state the independence of an integral on arbitrary closed two-dimensional surfaces pertaining to the light cone. (JFP)

7554 THIRD-ORDER EQUATION FOR BISPINORS. Marx, E. (Harry Diamond Labs., Washington, DC). Int. J. Theor. Phys.; 10: No. 4, 253-260(Aug 1974).

The general features of a bispinor field that obeys a third-order equation are presented. It separates into two massive fields that obey the Dirac equation and a four-component massless field. Its electromagnetic interactions and a leptonic interaction that introduces a mass difference are discussed briefly. This field can thus describe the electron, the muon, and both neutrinos. The difficulties related to inconsistencies between electromagnetic and weak interactions for the two-component spinors are still present for the bispinor field. (auth)

7555 ELECTRIC-DIPOLE-MOMENT ENHANCEMENT FACTOR FOR THE THALLIUM ATOM, AND A NEW UPPER LIMIT ON THE ELECTRIC DIPOLE MOMENT OF THE ELECTRON. Sandars, P. G. H. (Oxford Univ.); Sternheimer, R. M. Phys. Rev., A; 11: No. 2, 473-476(Feb 1975).

Some time ago, an accurate upper limit on a possible permanent electric dipole moment of the thallium atom in the $6\ ^2P_{1/2}$ ground state was obtained by Gould. The result was D_{Tl} equals $[(1.3 \pm 2.4) \times 10^{-21}$ cm]e. In connection with this value, a calculation of the electric dipole enhancement factor R_{Tl}, which is defined as the ratio D_{Tl}/D_e, where D_e is the corresponding upper limit on a possible electric dipole moment of the (valence) electron was carried out. A value R_{Tl} equals 700 was obtained, which leads to an upper limit D_e equals $[(1.9 \pm 3.4) \times 10^{-24}$ cm]e. This result is comparable with the value D_e lt $(3 \times 10^{-24}$ cm)e previously obtained by Weisskopf et al. from measurements on the cesium atom, and with the result of Player and Sandars of $[(0.7 \pm 2.2) \times 10^{-24}$ cm]e obtained from the search for an electric dipole moment in the $^3P_2$ metastable state of xenon. All three results set a stringent upper limit on the amount of a possible violation of T and P invariance in electromagnetic interactions. (auth)

7556 PONDEROMOTIVE EFFECT OF ELECTROMAGNETIC WAVES. Kalinnikov, I. I. Nyumin, M. I.; Popov, V. M. pp 23-28 of Teoriya Otnoitel'nosti i Gravitatsiya. Stanyukovich, K. P. (ed.). Moscow; Izdatel'stvo Nauka Glavnaya Redaktsiya Vostochnoi Literatury (1974). (In Russian)

From meeting of Society of Naturalists on theory of relativity and gravitation; Moscow, USSR (26 Apr 1974). See CONF-740493–.

An expression is derived for the minimum detectable amplitude of the intensity of a variable magnetic field and numerically evaluated for a rod with fixed dimensions and parameters. An experimental installation for verifying the relations derived is described. The dependence of the size of the relative signal on the size of the constant and variable fields was determined and compared with experimental values obtained with the installation described. (JSR)

7557 STATISTICAL SOLUTION OF THE EQUATION OF SOME FORMS OF THE INTERACTION OF ELECTROMAGNETIC AND MASSLESS SCALAR FIELDS. Shikin, G. N. pp 57-62 of Teoriya Otnositel'nosti i Gravitatsiya. Stanyukovich, K. P. (ed.). Moscow; Izdatel'stvo Nauka Glavnaya Redaktsiya Vostochnoi Literatury (1974). (In Russian).

From meeting of Society of Naturalists on theory of relativity and gravitation; Moscow, USSR (26 Apr 1974). See CONF-740493–.

The Lagrangian of a system of interacting electromagnetic and massless scalar fields is solved for two types of interaction. (JSR)

7558 CONSERVATION EQUATIONS OF THE CHARGE AND CURRENT DENSITIES OF A FREE RELATIVISTIC ELECTRON. Chow, R. L. (California State Coll., Turlock). Int. J. Theor. Phys.; 11: No. 6, 425-427(Dec 1974).

The four-current density j_μ is first decomposed into convection current part and spin current part, respectively. It is then demonstrated that the convection current density and spin current density are independently conserved. (auth)

7559 SOME REMARKS ON THE DYNAMICAL ORIGIN OF CHARGE AND SPACE–TIME QUANTISATION. Bandyopadhyay, P. (Indian Statistical Inst., Calcutta). Int. J. Theor. Phys.; 10: No. 3, 175-178(Aug 1974).

It is argued that the concept of dynamical origin of charge as formulated previously (Bandyopadhyay. Int. J. Theor. Phys.; 8: 323 (1973)) requires the quantization of space-time. Indeed, in this scheme, it is pointed out that the quantization of electric charge in units of e is a direct consequence of this space-time quantization. (auth)

7560 TWO-PHOTON EXCHANGE IN ED SCATTERING AT HIGH MOMENTUM TRANSFER. Lev, F. M. (Kharkov Complex Scientific Research Inst.). Yadern. Fiz.; 21: No. 1, 89-100(Jan 1975). (In Russian).

The expressions are obtained and the estimations are made for the ed-scattering effects due to the two-photon exchange, i.e., for the T-odd correlations and for the difference of the cross sections of e^-d and e^+d scattering. (1 table, 3 fig.) (auth)

7561 KHIMICHESKAYA POLYARIZATSIYA ELEKTRONOV I YADER. (Chemical Polarization of Electrons and Nuclei). Buchachenko, A. L. Moscow; Izdatel'stvo Nauka (1974). 246p.

This book presents the present state of the theory of the chemical polarization of electrons and nuclei. Theory is considered, and the method of chemical polarization of nuclei (CPN) is applied to solving chemical problems, and experimental illustrations of the theory are also presented. CPN theory in weak magnetic fields and in a zero field is presented with experimental illustrations of the theory. Problems of the chemical polarization of electrons are treated. The effect of magnetic field on chemical reaction rate is discussed. (SJR)

7562 THEORETICAL ASPECTS OF e^+e^--ANNIHILATION INTO HADRONS. Fritzsch, H. (California Inst. of Tech., Pasadena). Fortschr. Phys.; 22: No. 7, 407-429(1974).

The treatment of the theoretical aspects of e^+e^- annihilation into hadrons covers total cross sections and basic symmetries, π^0 decay and e^+e^- annihilation, what can be wrong if $R_+ \to 2$, colored quarks and gluons, specific models, symmetry breaking and current products in the vacuum, saturation of the spectral function sum rules, applications to e^+e^- annihilation, generalized duality and e^+e^- annihilation, unmodified gauge theory of colored quarks and gluons, inclusive reactions, multiplicities, jets in the final state, and hadron production by two virtual photons. (JFP)

7563 SCALING TERMS IN e^+e^- ANNIHILATION. Lam, W. S.; Zarmi, Y. (Univ., Bielefeld, Ger.). Lett. Nuovo Cim.; 12: No. 17, 663-666(26 Apr 1975).

Data on e^+e^- annihilation into hadrons indicate a strong violation of the scaling behavior predicted by the parton model. The effect is studied in single-particle inclusive cross sections. (JFP)

7564 CORRELATED-PARTON MODEL AND e^+e^- REACTION. Inagaki, H. (Tokyo Metropolitan Univ.). Lett. Nuovo Cim.; 12: No. 17, 679-682(26 Apr 1975).

It is shown that the rising total hadron production cross section to muon pair production cross section ratio can be interpreted as the correlations among partons which vanish asymptotically. (JFP)

7565 GENERALIZED FREQUENCY SHIFT ASSOCIATED WITH TACHYONS ANTIPARTICLES. Lake, K.; Roeder, R. C. (Univ. of Toronto). Lett. Nuovo Cim.; 12: No. 16, 641-644(19 Apr 1975).

The generalized electromagnetic frequency shift is formulated in a stationary space–time to include the possibility of emission and absorption of photons by tachyons and also antimatter particles. (JFP)

7566 GAUGE INVARIANCE IN REACTIONS INVOLVING HIGHER SPIN PARTICLES. Eeg, J. O. (Univ. of Oslo). Lett. Nuovo Cim.; 13: No. 1, 14-18(3 May 1975).

Couplings and amplitudes involving higher spin particles written in the Joos–Weinberg formalism where the spin structure is more clear are presented. It is found that taking all the Feynman diagrams to a given first order in the coupling constants one obtains gauge invariance both in the Rarita–Schwinger and Joos–Weinberg formalisms for $\gamma N \to \pi\Delta$ and $\gamma N \to \rho\Delta$, provided the interaction Lagrangian does not contain a second or higher order derivative on the boson field and vertex functions taking care of the off-shell particles are used. (JFP)

Weak

Refer also to abstracts 8001 and 8011.

7567 (CONF-741095-, pp 53-55) Λ-PARTICLE DECAY WITH PION IN DUFFIN–KEMMER. Dragovic, B. G.; Popovic, D. S. (Inst. of Physics, Belgrad). Oct 1974.

From proceedings of the triangle seminar; Beograd, Yugoslavia (28 Oct 1974).

In proceedings of the triangle seminar.

The $\Lambda \rightarrow p + \pi^-$ and $\Lambda \rightarrow n + \pi^0$ modes of nonleptonic free decay are considered using the Duffin–Kemmer formalism for the pion description and starting from the interaction Lagrangian density for mesonic Λ decay. The standard matrix element for mesonic Λ lambda decay is found. (JFP)

7568 (CONF-741095-, pp 71-80) DECAY OF NON-MESONIC HYPERNUCLEI. Juric, M. K. (Inst. of Physics, Belgrade, Yugoslavia). Oct 1974.

From proceedings of the triangle seminar; Beograd, Yugoslavia (28 Oct 1974).

In proceedings of the triangle seminar.

The discussion of the decay of nonmesonic hypernuclei includes the ratio of nonmesonic to π mesonic decays, the neutron to proton stimulation ratio, and the characteristics of a stimulated decay with emission of a fast charged particle. (JFP)

7569 (COO-3071-121) OBSERVATION OF PROMPT MUONS FROM NUCLEON–NUCLEON INTERACTIONS. Bintinger, D.; Cheng, D.; Mann, A. K. (Pennsylvania Univ., Philadelphia (USA)). 1974. 20p. Dep. NTIS $4.25.

The direct production of muons in nucleon-nucleon collisions was observed. The production cross section is 10^{-4} of the pion production cross section for both mu^+ and mu^-, and is insensitive to changes in transverse momentum and bombarding energy. A limit for the production cross section of heavy penetrating leptons is given as a function of particle mass, momentum, and lifetime. (auth)

7570 (IC-74-29) THREE MASSES FOR THE MUON. Tangherlini, F. R. (International Centre for Theoretical Physics, Trieste (Italy)). May 1974. 29p. INIS.

It is proposed that the muon exhibits three masses in muonic atoms. For free-space and lightly-bound states, the mass derived from the pion-muon-nucleon mass relations is $m_\mu = (105.6596 \pm 0.0067)$ MeV, in agreement with the experimental value. For energy transitions in the 150 keV to 350 keV range, the previous value of $m_\mu = 105.652$ MeV is checked (±10 p.p.m.). For the 400 keV to 450 keV range, a new value, $m_\mu = (105.6448 \pm 0.0067)$MeV is proposed. This new lower value eliminates discrepancies in Ba and Pb and fits new transitions for Hg and Tl very well. The mass-difference $\delta m \cong 0.0074$ MeV between mass levels is discussed as a kind of mass-renormalization. Possible implications for the charged pion mass in pionic atoms and also for the neutral pion mass are examined. An SU(3) model of electron and neutrinos based on "threeness" is given, and from the model the $\pi-\mu-e$ mass relation is derived. Also an analogy with the baryon octet is constructed and discussed. (auth)

7571 (IC-74-81) ANOMALOUS LEPTON-HADRON INTERACTIONS AND GAUGE MODELS. Pati, J. C.; Salam, A. (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1974. 38p. INIS.

Parameters for anomalous lepton-hadron interactions (like their signs, V and A-character and allowed and forbidden nature of certain transitions) are abstracted from the class of gauge models proposed earlier. This information is used to determine the strength of the anomalous interactions by fitting e^-e^+-annihilation data. Then quantitative estimates of the energy-dependence of this cross section, the deviation of the ratio of (e^+p/e^-p) cross sections from unity at high q^2, and (apparent) deviations from scaling in ep-scattering are made. Also discussed are consequences of anomalous interactions (with the restrictions mentioned above) on enhanced lepton-production in hadronic collisions, hyperfine structure splitting in hydrogen and leptonic decay modes of η^0 and η. On the theoretical side, a variant of the basic gauge model (which allows the anomalous lepton-hadron interactions to be relevant at present energies) is discussed. The major conclusion both from the theoretical side (taking into account restrictions on low energy neutrino interactions) and from the phenomenological side (taking into account data on e^4 alone) is that the electron is likely to be "strange," if its interaction with hadrons is "anomalous" at present energies. Further data is needed to test this possibility and also whether the muon is anomalous and strange or nonstrange. It may of course be that leptons do possess anomalously strong interactions but only at high energies proposed in the basic gauge model, in which case such interactions are irrelevant for SLAC energies. (auth)

7572 (JINR-E2-8678) ASYMPTOTIC RELATIONS BETWEEN THE PROTON FORM FACTORS AND ELASTIC SCATTERING OF POLARIZED LEPTONS ON POLARIZED PROTONS. Bilenkaya, S. I.; Bilenkii, S. M.; Frenkel, A.; Hristova, E. H. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 13p. Dep. NTIS (U. S. Sales Only) $4.00.

It is shown that examining the asymmetries in elastic scattering of longitudinally polarized leptons on a polarized proton target in the high q^2-region makes it possible to ascertain the relation between the proton form factors. Data on the cross section of elastic e-p scattering were analyzed in the region $q^2 > 6$ $(GeV/c)^2$. It is shown that the data available cannot eliminate the equal behavior of the form factors F_1 and F_2 at high q^2-values. The investigation was performed at the Laboratory of Theoretical Physics, JINR. (auth)

7573 MASS DIFFERENCE OF K_L AND K_S MESONS. Volkov, M. K.; Pervushin, V. N. (Joint Inst. for Nuclear Research, Dubna, USSR). Yadern. Fiz.; 21: No. 1, 214-218(Jan 1975). (In Russian).

The mass difference of neutral kaons is calculated in the chiral quantum theory. It is shown that two-pion diagrams give the main contribution to the kaon mass difference. (auth)

Strong (General)

Refer also to abstracts 7947 and 7955.

7574 (CONF-7306115-P2, pp C.XIII1-C.XIII9) RECENT DEVELOPMENTS IN THE THEORY OF PADE APPROXIMANTS. Zinn-Justin, J. (CEN, Sarclay, France). 1973.

From 3rd international colloquium on advanced computing methods in theoretical physics; Marseille, France (25 Jun 1973).

In third international colloquium on advanced computing methods in theoretical physics, Marseille, June 25–29, 1973. (Centre National de la Recherche Scientifique, 13 - Marseille (France). Centre de Physique Theorique).

A certain number of new results in the theory of the convergence of Padé approximants are reported. The implications for numerical analysis, of the nature of the convergence, i.e., convergence in measure or capacity, are outlined. Some recent applications in theoretical physics are mentioned. (auth)

7575 (CONF-750506-2) NUCLEON–MESON TRANSPORT CALCULATIONS. Alsmiller, R. G. Jr. (Oak Ridge National Lab., Tenn. (USA)). 1975. 37p. Dep. NTIS $5.00.

From symposium on spallation nuclear reactions and their applications in astrophysics and radiotherapy; Philadelphia, Pennsylvania, USA (2 May 1975).

A review of medium and high energy nucleon-meson transport calculations carried out at the Oak Ridge National Laboratory in the past several years is presented. (auth)

7576 (CRN/HE-74-13) QUARKS FOR HADRONS AND LEPTONS. Leite Lopes, J. (Centre National de la Recherche Scientifique, 67 - Strasbourg (France). Centre de Recherches Nucleaires). 1974. 7p. INIS.

A previously formulated unified model of quarks for hadrons and leptons is discussed. The model has several difficulties, the most important one being the implication that leptons would be expected to display strong interactions; and that the incorporation of lepton and hadron quarks into a multiplet would lead to a violation of the laws of conservation of baryon and lepton numbers. (FR)

7577 (ITP-74-71E) DECAY PROPERTIES OF DUAL FIXED-SPIN RESONANCES. Makarov, V. I. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1974. 14p. Dep. NTIS (US Sales Only) $4.00.

The basic properties of a fixed-spin resonance decay are considered on the basis of the statistical approach to dual resonance models. The analytic dependence of the widths of resonances on their masses and spins is obtained, the contribution of different decay modes to the width, energy spectrum and multiplicity of secondary particles is estimated. On the basis of these calculations the conjectured picture of total dual resonance decay is described. (auth)

7578 (JINR-P2-8588) QUARK INTERCHANGE IN PROCESSES WITH LARGE MOMENTUM TRANSFER BETWEEN MESONS AND BARYONS. Lyubimov, A. L. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 17p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The consequences of quark interchange between interacting hadrons are considered. The ratios of the cross sections for

different reactions are given for elastic meson-baryon scattering at 180°, for inelastic processes with large momentum transfer between meson and baryon. The ratios obtained are determined by the number of quarks in hadrons and make possible one more approach to experimental testing of the quark model. (auth)

7579 (RRK-73-20) SCALING OF ASSOCIATED MULTIPLICITY AND A TEST OF SEMI-INCLUSIVE SCALING. Minakata, H. (Hiroshima Univ., Takehara (Japan). Research Inst. for Theoretical Physics). Nov 1973. 8p. INIS.

An attempt is made to show that the scaling law proposed by Koba, Nielsen, and Olesen implies the scaling laws of associated multiplicity and associated moments. An important point is that it provides a new method for testing semi-inclusive scaling. By defining the associated multiplicity $\langle n\xi \rangle$ and the associated moments $\langle n\xi^m \rangle$, the scaling law of the associated multiplicity that the quantity $\langle n\xi \rangle / \langle n \rangle$ does not have s-dependence without through variable ξ was obtained, where ξ means a suitably chosen kinematical variable, e.g., momentum transfer t, where M is missing mass, s is c.m.s. -energy squared, and $\langle n \rangle$ is the average multiplicity for charged particles. The scaling of the associated moments was also derived. The present scaling was tested in the energy range from 28.5 to 303 GeV/c by using the data by NAL bubble chamber experiment. Plot of $\langle n_{ch} \rangle / \langle n \rangle$ versus M^2/S is shown, where $\langle n_{ch} \rangle$ means the average multiplicity for charged particles in the reaction $p + p \rightarrow p +$ anything. Apart from several fluctuating data points, the scaling of associated multiplicity is satisfied well over wide energy range. However, the conclusion that the data obey the scaling, cannot be the final one. The compatibility of the present scaling with the s-independence of the associated multiplicity is discussed. (JA)

7580 (RRK-74-7) POSSIBLE PAIR-CORRELATION EFFECTS IN THE MULTIPLICITY DISTRIBUTION. Namiki, M.; Ohba, I.; Yokoyama, K. (Hiroshima Univ., Takehara (Japan). Research Inst. for Theoretical Physics). Jun 1974. 14p. INIS.

Possible pair-correlation effects in the multiplicity distribution of the high energy multiple production are discussed in some detail with analogy to the many body theory. It is shown that the interference term of the uncorrelated jet state and the pair-correlated jet state gives us the sign change (from negative to positive) of the second moment in the multiplicity distribution. (auth)

7581 SQUARE-ROOTS, INTERNAL SYMMETRIES, AND FERMION FIELD QUANTIZATION. Rosen, G. (Drexel Univ., Philadelphia). Int. J. Theor. Phys.; 11: No. 5, 305-308(Dec 1974).

It is observed that the complex square-root of the hermitian matrix $\sigma\mu_{p_\mu}$ associated with a physical four-momentum admits Lorentz-independent unitary transformations that may be related to the internal symmetries of hadrons. An operator-valued square-root of the Hilbert space inner product in relativistic one-electron theory brings in fermion field quantization conditions as a direct concomitant of its linearity and hermicity properties. (auth)

7582 DOES THE 3105 CAUSE VACUUM POLARIZATION EFFECTS. Humpert, B. (Univ. of Geneva). Lett. Nuovo Cim.; 12: No. 13, 473-479(29 Mar 1975).

In the framework of quantum electrodynamics the assumptions that ψ is directly coupled to the photon according to vector meson dominance and that it is of hadronic nature are investigated as to their experimentally measurable consequences. The conclusion is found that ψ causes a strong variation of the vacuum polarization leading to a considerable effect on the total cross sections for μ-pair production. (JFP)

7583 FAMILIES OF γ QUANTA AND HADRONS AND NUCLEAR CASCADE PROCESS. Vdovchi, J. S.; Fomin, Yu. A.; Khristiansen, G. B. (Inst. of Nuclear Physics, Moscow). Yadern. Fiz.; 21: No. 1, 154-160(Jan 1975). (In Russian).

Calculation of three-dimensional development of the hadron and electromagnetic cascades in an extensive air shower at various primary energies is carried out. The obtained results are analyzed in view of production of families of γ quanta and hadrons. Characteristics of these families obtained as a result of the calculations are presented. It is shown that for the assumed model of the nuclear cascade process the main contributions to the families are from various interactions of the nucleon and secondary pions; the fraction due to the one-act events in the observed families is negligible. (6 figures, 3 tables) (auth)

7584 GAUGE INVARIANCE OF STRONG INTERACTIONS. Bogomol'nyi, E. B. (Moscow Physical-Tech. Inst.). Yadern. Fiz.; 21: No. 1, 219-226(Jan 1975). (In Russian).

Inclusion of strong interactions into the gauge theories with spontaneous symmetry breaking is discussed with no reference to a specific hadronic Lagrangian. A simple method is presented to find necessary and sufficient conditions that the strong interactions do not break the gauge invariance of such theories. The obtained conditions determine the vertices of emission of the Higgs scalar particles in terms of equal-time commutators of charges of the gauge group with the current divergencies. (auth)

7585 ISOTOPIC RELATIONS FOR TWO-PARTICLE INCLUSIVE REACTIONS. Lyuboshits, V. L.; Podgoretskii, M. I. (Joint Inst. for Nuclear Research, Dubna, USSR). Yadern. Fiz.; 21: No. 1, 205-213(Jan 1975). (In Russian).

Based on the Shmushkevich method, model-free isotopic relations between the effective cross sections of two-particle inclusive processes and also between the second moments of multiplicity distribution have been obtained. The approach developed is convenient for analyzing the isotopic structure of correlations of the particles with a small relative momentum. (auth)

7586 HADRON INTERACTION AND QUANTUM DYNAMICS OF CLOSED STRINGS AND RELATIVISTIC MEMBRANES. Laperashvili, L. V.; Shoikhet, V. Kh. (Tbilishi State Univ., USSR). Yadern. Fiz.; 21: No. 1, 197-204(Jan 1975). (In Russian).

Construction of N-particle hadron amplitudes is considered that is based on interaction of relativistic quantized closed strings resulting in the Virasoro–Shapiro dual amplitude, as well as on interaction of quantized membranes. Comparing these two models of the hadron interaction one shows that they provide with identical asymptotical Regge-type behavior of the four-point amplitudes. (auth)

7587 QUARKIUM: A BIZARRE FERMI LIQUID. Carruthers, P. (Cornell Univ., Ithaca, NY). Collect. Phenomena; 1: No. 3, 147-161(Jan 1974).

An attempt is made to change the arena for quark dynamics in a drastic way. It is suggested that the reason quarks are not seen is that they are everywhere. The theory is analogous to superconductivity, in which singie electron excitations cannot exist in the energy gap due to the collective motion of the medium. The aim is to recognize the mesons as collective oscillation of the medium and to associate the superconducting transition with the formation of bound triplets. Therefore, the ground state of the universe is expected to be a state containing nucleons. (JFP)

7588 SPECULATIONS ON THE EFFECTS OF GRAVITATION AND COSMOLOGY IN HADRON PHYSICS. Sarfatt, J. (California State Univ., San Diego). Collect. Phenomena; 1: No. 3, 163-167 (Jan 1974).

It is conjectured that there exists a truly fundamental particle ("on") of mass 10^{-5} gm, arising from quantum fluctuations in the geometry of space-time. The on is described by a possibly charged Kerr metric, and can be thought of as a nonluminous "quantum black hole." Ons are conjectured to account for 10^{56} gm of mass in the universe, whereas leptons and hadrons only account for about 10^{53} gm. It is predicted that ons will be detected directly if they are looked for. Hadrons are formed in the gravitational collapse of a possibly superfluid phase of ons with the release of $\approx 10^{19}$ GeV. The characteristic hadron mass of 1 GeV may be determined by the Hubble radius in a manner reminiscent of Eddington's conjectures. The initial singularity in the big bang cosmology, as well as the "interiors" of gravitationally collapsed cold stars, should consist entirely of ons. The relation of the on hypothesis to Salam's f-gravity; Bjorken scaling in deep inelastic lepton-hadron scattering; reggeons, pomerons, and duality in diffraction dissociation hadron-hadron collisions are discussed. (auth)

7589 EIGHTFOLD WAY AS A CONSEQUENCE OF THE GENERAL THEORY OF RELATIVITY. Sarfatt, J. (California State Univ., San Diego). Collect. Phenomena; 1: No. 3, 169-172(Jan 1974).

Petrov's local algebraic classification of the Riemann–Christoffel curvature tensor in terms of a bivector space at each space-time event gives a geometric interpretation to the eightfold way of internal symmetry classification of hadrons. The Einstein coordinate transformations GL(4,R) on curved space-time induce unitary transformation on the three-complex dimensional bivector space. Bivectors have a natural chiral decomposition which implies a natural SU(3) × SU(3) classification which is implicit in the space-time order of general relativity. Explicit symmetry breaking of the Lagrangian is induced in SU(3) "quark" space by the space-time curvature. The problem of combining internal with space-time symmetries as expressed in the "no go" theorems is, in a sense, solved in that the dilemma is shown to be based on a confusion of complementary ways of describing experiments. Two separate arguments are given as to why space-time curvature should be a strong effect for hadrons. (auth)

Strong (Baryon No. = 0)

Refer also to abstract 7959.

7590 (CONF-741095-, pp 43-52) STATISTICAL APPROACH TO PRODUCTION PROCESSES. Martinis, M. (Institute Rudjer Boskovic, Zagreb). Oct 1974.

From proceedings of the triangle seminar; Beograd, Yugoslavia (28 Oct 1974).

In proceedings of the triangle seminar.

Simple arguments are given in favor of a statistical approach to production processes similar to the one developed in quantum optics. In particular, pion distributions resulting from a chaotic (random) c-number source are discussed. (auth)

7591 (ITP-74-146P) $\pi\pi$-SCATTERING IN DUAL MODEL WITH POMERON. Krivskii, I. Yu.; Lend'el, A. I.; Lend'el, V. I. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1974. 21p. (In Russian). Dep. NTIS (US Sales Only) $4.25.

The dual model with Mandelstam analyticity previously proposed is used for the description of the $\pi\pi$-scattering. The ρ-meson and the Pomeranchukon trajectories are taken into account. The main merit of the model is its unitarity, though approximate. In particular, taking into account the Pomeranchukon trajectory with a small slope ensures the unitarity of the T_2-wave. Such characteristic features of the $\pi\pi$-scattering as broad resonance in the S-wave (which is obtained as a daughter resonance), constant total scattering in several tens of GeV energy region and close to Weinberg's scattering lengths are obtained. (auth)

7592 (JINR-E2-8549) $\Delta\Delta$-PLOT. Kopylov, G. I. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 15p. Dep. NTIS (US Sales Only) $4.00.

The properties of a plot which facilitates the observation of two-particle-state interference are discussed. The plot permits the space-time characteristics of the multiple pion production to be determined. (auth)

7593 (JINR-E2-8656) INTERPRETATION OF PSI-MESONS IN THE THREE-TRIPLET MODEL WITH INTEGRAL CHARGES. Gerasimov, S. B.; Govorkov, A. B. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 13p. Dep. NTIS (US Sales Only) $4.00.

Recently discovered narrow ψ (3105)- and ψ(3695)-mesons were interpreted as the new ω- and ϕ-mesons predicted by the three-triplet model, and consequences of this identification are discussed. (auth)

7594 (JINR-P2-8647) MECHANISM OF THE PSI-MESON DECAY SUPPRESSION. Efremov, A. V. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 12p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

From the renormalization group consideration it follows that the relative suppression of ψ- to ϕ-decay widths is due to the decrease of the quark effective coupling constant with increasing resonance mass when assuming the quantum numbers of ψ and ϕ are identical and the limit $\Gamma_{\phi(\psi)\to 3\pi}$ exists as $m_\pi \to 0$. The decrease of g^2 due to the "asymptotical freedom", with $g^2 = 0.55$ proposed previously, seems to contradict the wide-angle pp-scattering data, because the simplest quark diagrams with the suppressing factor $(g(s,g))^{10}$ additional to the quark counting power s^{-10}. To avoid this contradiction a finite charge renormalization scheme, with a small g_3^2 ("short distance scale invariance") has been proposed. (auth)

7595 (JINR-P2-8568) LOW-ENERGY $\pi\pi$ SCATTERING AND THE PION ELECTROMAGNETIC FORM FACTOR. Malyshkin, V. G. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 24p. (In Russian). Dep. NTIS (US Sales Only) $4.25.

A $\pi\pi$ scattering model with Lagrangian of the $(\pi\partial\mu\pi)^2$ type is proposed. It is shown that the Redmond–Bogolubov–Logunov–Shirkov summation principle, applied to a set of one-loop diagrams, and the appropriate regrouping of the perturbation theory series lead to the renormalizable model. In the framework of this model there were calculated the $\pi\pi$ scattering phases and the electromagnetic pion form factor. (7 figures, 1 table) (auth)

7596 (LBL-3687) SOME PROPERTIES OF THE PSI(3.7) RESONANCE, AND FEATURES OF THE TOTAL HADRONIC CROSS SECTION IN e^+e^- ANNIHILATION FROM 2.4 GeV TO 5.0 GeV C.M. ENERGY. Kadyk, J. A.; Abrams, G. S.; Briggs, D. D. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). 25 Apr 1975. Contract W-7405-eng-48. 19p. (CONF-750309-1; CONF-750307-5). Dep. NTIS $4.00.

From 10th moriond meeting; Meribel-les-Allures, France (2 Mar 1975).

An analysis of data at the psi(3.7) resonance gives a partial width to electrons, GAMMA/sub e/ equals 2.2 +- 0.5 keV, and limits on total width 200 keV less than GAMMA less than 800 keV. The decay psi(3.7) yields psi(3.1)pi^+pi^- is observed with a branching ratio 0.31 +- 0.04, and psi(3.7) yields psi(3.1) + anything has a branching ratio of 0.54 +- 0.08. The psi resonances appear to have the same G-parity. An enhancement occurs in the total hadronic cross section at a c.m. energy of about 4.1 GeV, rising to about 32 nb from a level of 18 nb adjacent to peak, which is about 300 MeV wide. The integrated cross section for the peak is about 5.5 nb-GeV, comparable to that for the psi(3.7) and psi(3.1) resonances. (auth)

7597 (NBI-HE-74-18) TWO MASS RELATIONS FOR MESONS FROM STRING: QUARK DUALITY. Brink, L.; Nielsen, H. B. (Goeteborg Univ. (Sweden). Institutionen foer Teoretisk Fysik; Niels Bohr Institutet, Copenhagen (Denmark)). Dec 1974. 29p. Dep. NTIS $4.50.

A self-consistency equation derived previously by the authors for the Nambu String is generalized to strings carrying SU(6) quantum numbers. The self-consistency equations are derived by considering the propagation of a string with the quantum numbers of the physical vacuum. Since the world sheet that the string sweeps out can be mapped onto rectangles and the wave function of the physical vacuum is a constant, the boundary conditions are the same on all four sides of the rectangles. The propagator can be calculated in two ways and this leads to the self-consistency equations. For the strings carrying SU(6) quantum numbers the propagator of strings is considered with the quantum numbers of the physical vacuum all along the string except for having quark quantum numbers either attached or removed from the ends. These self-consistency equations can be solved in a certain approximation and for this case they lead to mass formulas for mesons that are well satisfied in nature. (auth)

7598 (RL-75-011) THE BUDDING POMERON IN THE TREE APPROXIMATION TO $\pi\pi$ INELASTIC CHANNELS. Pennington, M. R. (Science Research Council, Chilton (UK). Rutherford Lab.). Jan 1975. 28p. (T-104). Dep. NTIS (US Sales Only) $4.50.

To study how the budding pomeron is produced in meson-meson scattering the first inelastic channels to couple strongly to $\pi^+\pi^+$ are investigated. The $\pi^+\pi^+ \to \rho^+\rho^+$ and $\pi^+\pi^+ \to \pi^+A_1^+$ cross sections are calculated in the tree graph approximation—with the ratio of $A_1 \to \rho\pi$ decay rates computed on the way. It is concluded that either the pubescent pomeron is not precocious in $\pi\pi$ scattering or factorization is not fulfilled. (auth)

7599 CHIRAL AND SCALE VARIANCE. D'Cruz, J. C. (Queen Mary Coll., London). J. Phys. G: Nucl. Phys.; 1: No. 2, 151-158(21 Feb 1975).

At the two-dimensional level a consistent formulation of a nonlinear chiral model for pions and scale invariance can be maintained, at least at the nonperturbative stage. It is shown using Ward identities and dimensional regularization how this consistency breaks down to lowest order in perturbation theory. It is also indicated how the introduction of an extra field overcomes this breakdown. (auth)

7600 INTERPRETATION OF THE $N\bar{N} \to n\pi$ CROSS SECTIONS AT LOW MOMENTA IN A STATISTICAL FRAMEWORK. Vandermeulen, J. (Univ., Liege). Lett. Nuovo Cim.; 12: No. 13, 480-484(29 Mar 1975).

A recent analysis of proton–antiproton annihilation at rest into pions is extended to the study of cross sections for $\bar{p}p$ and $\bar{p}n$ annihilation in flight at low momenta (below 2 GeV/c). The available data are compared to the predictions of a model inspired by the statistical bootstrap. A good general agreement with the magnitude and energy variation of the cross sections is reached. (JFP)

7601 ROLE OF CROSSING AND ANALYTICITY IN LOW-ENERGY PION–PION SCATTERING. Kuehnelt, H. (Univ., Vienna). Acta Phys. Austr.; 38: No. 3, 256-271(1973). (In German).

The role of the analyticity and crossing properties of pion-pion scattering amplitudes for the derivation of quantitative statements was shown. The application of crossing summation rules for the absorptive part in the physical region permits the estimation of an exact lower limit for the $\pi^0\pi^0$ S wave scattering length $a_0^{00} > -1.08/m_\pi$, which can be improved by use of experimental data on the D wave scattering length at $a_0^{00} > -0.47/m_\pi$. (tr-auth)

7602 RESONANCES IN HIGH-MULTIPLICITY REACTIONS. Hayot, F. (Univ. of Michigan, Ann Arbor). Lett. Nuovo Cim.; 12: No. 17, 676-678(26 Apr 1975).

An exercise is discussed indicating that in practice it is very difficult to differentiate between the decay mode $\pi^+\pi^-2\pi^0$ (= $\rho^+\rho^-$) of a presumed neutral cluster and a pair of ρ^+ and ρ^- resonances correlated through local charge conservation. In principle there is an important dynamical distinction. In the latter case the dynamical mechanism for correlation is clearly spelled out, while

in the former case it is not, the dynamics of the formation of the so-called cluster remaining obscure. (JFP)

7603 MESON MASS RELATIONS AND MIXING IN $U_4 \times U_4$. Montonen, C.; Roos, M.; Toernqvist, N. (Univ. of Helsinki). Lett. Nuovo Cim.; 12: No. 16, 627-632(19 Apr 1975).

A previous analysis of theoretical expectations of the properties of charmed particles predicting a particle ϕ_c with approximately the correct properties to correspond to the $\psi(3105)$ is continued in the light of the experimental data, and strong support is found for the interpretation of the $\psi(3105)$ as an almost pure $c\bar{c}$ system. As a consequence of this nearly ideal mixing, several simple mass relations follow. Those mass relations which do not involve charmed particles and which therefore can be tested on other SU(3) nonets than vector mesons, exhibit remarkable agreement for linear as well as quadratic masses. The mass relations are used to predict missing mesons in incomplete nonets. (JFP)

7604 SELF-INTERACTING FIELD THEORY OF NEUTRAL PSEUDOSCALAR MESONS. Burt, P. B. (Clemson Univ, SC). Lett. Nuovo Cim.; 13: No. 1, 26-28(3 May 1975).

It is shown that neutral, pseudoscalar mesons can be described by quantized solitary-wave solutions of nonlinear, self-interacting quantum field theories. A mass relation for these mesons is given. (JFP)

Strong (Baryon No. = 1)

7605 (CONF-741095-, pp 15-29) SEARCH FOR DIFFRACTIVE CLUSTERS IN THE REACTIONS $K^-p \to (K^-n\pi)p$ AT 10 AND 16 GeV/c. Buschbeck, B.; Markytan, M. (Akademie der Wissenschaften, Vienna). Oct 1974.

From proceedings of the triangle seminar; Beograd, Yugoslavia (28 Oct 1974).

In proceedings of the triangle seminar.

Clusters are associated with fireballs in the sense of subjects which decay independently of their production. Particle systems that can be interpreted as clusters by isotropic decay distributions such as the low mass ($K^-\pi^+\pi^-$) and ($p\pi^+\pi^-$) systems in the reaction $K^-p \to K^-\pi^+\pi^-p$ are considered. Also clustering can be viewed as being the result of strong attraction among the diffractively produced $K^{*0}\pi^-$ and $\Delta^{++}\pi^-$ systems at small effective mass. Also considered is the particle system ($K^-\pi^+\pi^-\pi^0$) in the reaction $K^-p \to K^-\pi^+\pi^-\pi^0p$ at 16 GeV/c. (JFP)

7606 (FRNC-TH-498) DEVELOPMENT OF NEW METHODS FOR THE ANALYSIS OF TWO-BODY REACTIONS: 1/2 + 0. Urban, Urban, M. (Paris-11 Univ., 91—Orsay (France)). 1973. vp. (In French). INIS.

Thesis.

A critical study of phase shift analyses is given for a precise physical example: K^+p elastic scattering. Six irreducible defects were shown. Zerology, used for this criticism, proved suitable for this physical example in spite of the absence of near zeros and a mathematical optimization of the zero estimators was developed. A conformal transformation adapted to zerology was established. The exact limits of this type of method were also defined from a computerized simulation of scattering experiments, by drawing at random. The statistical problem of obtaining the density of probability of the roots of a polynomial when that of the coefficients is given was rigorously resolved. As a result it was possible to predict and explain unexpected phenomena in the behavior of the zeros and correct the estimators. On the basis of the experimental $K^+p \to K^+p$ data the zeros of the reaction were estimated at several energies. Polar adjustments show that two poles close to rho and Λ^0, not proving the usual analyticity hypotheses, perfectly approximate the K^+p data. Finally arguments are given against the formation of exotic resonances in K^+p below 2 GeV/C. (auth)

7607 (ITP-74-109P) NEW AXIOMATIC RESTRICTIONS ON THE DIFFERENTIAL AND TOTAL CROSS SECTIONS. Lomsadze, Yu. M.; Kelemen, V. I. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1974. 15p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

New integral and local relations between the differential and total cross sections are obtained. The relations are based on the general properties of scattering amplitude which are rigorously proved within the axiomatic quantum field theory. These relations may serve both the aim of experimental verification of the quantum field theory principles and the aim consistent with these principles, of theoretical predictions of the behavior of these cross sections in the energy region not accessible as yet for experiment. (auth)

7608 (JINR-P1-8677) CHARGE EXCHANGE IN π^-n INTERACTIONS AT 40 GeV/c. Angelov, N.; Aniola, L.; Ivanovskaya, I. A.; Kladnitskaya, E. N.; Mel'nikova, N. N.; Mikhul, A.; Fadeev, N. G. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 15p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

Multiple production of particles in π^-n interactions is studied from the point of view of the charge exchange between the total charge of forward going particles and of the incident π^--meson. The average charge exchange, $-\langle\Delta Q\rangle$, is shown to differ from zero and to be equal to 0.23 ± 0.03. The largest contribution to the distribution on ΔQ is from the events with $\Delta Q = 0$ and $\Delta Q = 1$ ($\approx$75%). This fact evidences in favor of the preferential role of the multiperipheral type processes. The distribution over value $(\Delta Q - \langle\Delta Q\rangle)$ coincides with the corresponding distributions for π^-p, K^-p and pp-interactions in the momentum range from 10 to 205 GeV/c. (auth)

7609 (JINR-P2-8444) REACTION $\pi^-p \to m\gamma\gamma'$ AT LOW ENERGIES. 1. Calculation of the Simplest Pole Diagrams. Vishinesku, M.; Dubovik, V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 17p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The pole diagrams, describing the $\pi^-p \to m\gamma\gamma'$ reaction taking into account $\Delta(1232)$ contributions in the intermediate state of dominating diagrams, are calculated. The possibilities are considered of separate experimental studies of different processes of this reaction. (auth)

7610 (RL-75-055) KAON-NUCLEON PARTIAL WAVE AMPLITUDES BELOW 1.5 GeV/c FOR I = 0 AND 1. Martin, B. R. (Science Research Council, Chilton (UK). Rutherford Lab.). Mar 1975. 29p. Dep. NTIS (US Sales Only) $4.50.

Kaon-nucleon partial wave amplitudes for isospin I = 0 and 1 are presented from a simultaneous phase shift analysis of K^+p and K^+d data in the region below 1.5 GeV/c kaon laboratory momentum. (auth)

7611 DISPERSION RELATIONS FOR THE LOGARITHM OF THE K^+-p FORWARD SCATTERING AMPLITUDE. Dumbrajs, O.; Staszel, M. (Univ., Warsaw). J. Phys. G: Nucl. Phys.; 1: No. 2, 172-179(21 Feb 1975).

Dispersion relations for the logarithm of the K^+-p forward scattering amplitude were derived and evaluated. The prominent role played by zeros of the amplitude is revealed and the present insufficiency of knowledge of locations of zeros is discussed. The results of the calculations are in qualitative agreement with most of the experimental data. (auth)

7612 NEW SEMICLASSICAL ELEMENTARY PARTICLE MODEL. Delaney, W. (Centro Studi e Applicazioni in Technologie Avanzate, Bari, Italy). Int. J. Theor. Phys.; 10: No. 4, 239-251(Aug 1974).

A semiclassical model in which elementary particles are represented as systems of charged shells with associated quark-like quantum numbers is presented. Specifically the baryons are considered. Formulas are obtained which express baryon masses and magnetic moments in terms of model parameters which relate baryon and quark properties. Basically, the mass and moment formulas are expressions for mass ratios and magnetic moment ratios. Simple identifications for the model parameters lead to a prediction for the proton-electron mass ratio and to fairly accurate predictions for the baryon magnetic moments in units of the proton moment. The mass and moment formulas, which relate corresponding properties of different particles, are generalized such as to express relations between the members of a sequence of particles, where such a sequence is conceived of as containing only one (normal) baryon. A specific sequence, containing the proton and electron, is proposed; various physical properties of the particles in the sequence are determined. In particular, a second prediction for the proton-electron mass ratio is obtained; the two predictions differ numerically, but both agree with the measured value of the mass ratio within experimental error. (auth)

7613 MULTIPLICITY CORRELATIONS OF NEUTRAL AND CHARGED π MESONS. Angelov, N.; Grishin, V. G.; Kerachev, P. (Joint Inst. for Nuclear Research, Dubna, USSR). Yadern. Fiz.; 21: No. 1, 166-170(Jan 1975). (In Russian).

The π^-p 40 GeV/c data are used to calculate the dispersion and the correlation coefficient ρ_1^0 of the multiplicity distribution of π^0 mesons ($D_0 = 2.94 \pm 0.15$ and $\rho_1^0 = 0.51 \pm 0.15$). Isotopic relations for the correlation coefficients $\rho_{\frac{1}{2}}^1$ are obtained for isotopically nonpolarized system of π mesons. (2 tables) (auth)

7614 RELATIONS BETWEEN INCLUSIVE PROCESSES IN THE FRAGMENTATION REGION IN ONE-PION EXCHANGE MODEL. Boreskov, K. G.; Kaidalov, A. B.; Ponomarev, L. A. (Inst. of Theoretical and Experimental Physics, Moscow). Yadern. Fiz.; 21: No. 1, 161-165(Jan 1975). (In Russian).

Based on the one-pion exchange model relations are obtained between the π^--meson spectra in the proton fragmentation region at interactions of various particles with the proton. It is shown

that these relations are in reasonable agreement with the available experimental data. It is noted that the model predicts the character of approaching the asymptotic limit unambiguously. (1 table, 3 figures) (auth)

7615 SEPARATION OF DIFFRACTION DISSOCIATION MECHANISM WITH THE LONGITUDINAL PHASE SPACE PLOT. Beketov, G. V.; Zombkovskii, S. M.; Kaidalov, A. B.; Konovalov, B. S.; Kruchinin, S. P.; Pozhidaeva, N. A.; Selector, Ya. M.; Turov, V. F.; Shulyachenko, V. N. (Inst. of Theoretical and Experimental Physics, Moscow). Yadern. Fiz.; 21: No. 1, 193-196(Jan 1975). (In Russian).

The π-pole Regge exchange model was used to calculate cross sections of the reaction $\pi^- p \to p\pi^+\pi^-\pi^-$ at 4.5; 11 and 16 GeV/c momenta in the longitudinal phase space region corresponding to pion dissociation. The obtained results agree well with experimental data. (4 figures) (auth)

7616 MASSES AND WIDTHS OF THE Δ^{++} AND Δ^0 RESONANCES. Lichtenberg, D. B. (Indiana Univ., Bloomington). Lett. Nuovo Cim.; 12: No. 16, 616-618(19 Apr 1975).

Using previous phase shifts, new values of the masses and widths of the Δ^{++} and Δ^0 resonances were obtained. The method is to parametrize the scattering amplitude with a simple function containing three adjustable parameters. (JFP)

Strong (Baryon No. ≥ 2)

7617 (CONF-7306115-P2, pp C.XVII-C.XVI3) MATRIX PADE APPROXIMANTS. Turchetti, G. (Univ., Bologna). 1973.

From 3rd international colloquium on advanced computing methods in theoretical physics; Marseille, France (25 Jun 1973).

In third international colloquium on advanced computing methods in theoretical physics, Marseille, June 25-29, 1973. (Centre National de la Recherche Scientifique, 13 - Marseille (France). Centre de Physique Theorique).

A recent improved approximation is considered for the amplitudes with one or two spin-$\frac{1}{2}$ particles as πN and NN. The basic idea is to exhaust at any order the information provided by a Lagrangian by approximating the Green functions rather than the S matrix. It is concluded that except for the S waves and the 1 and 2 pion forces correctly treated account for all the relevant features of NN dynamics. (JFP)

7618 (CONF-741095-, pp 3-14) SINGLE DIFFRACTION DISSOCIATION AT HIGH ENERGIES. Majerotto, W. (Akademie der Wissenschaften, Vienna). Oct 1974.

From proceedings of the triangle seminar; Beograd, Yugoslavia (28 Oct 1974).

In proceedings of the triangle seminar.

Single inelastic diffractive excitation is considered in particular, the recent data on the reaction $pp \to p + n\pi^+$ at $\sqrt{s} = 23$ GeV. An s-channel description of diffraction dissociation is presented taking into account absorption in the initial and final state. The mass and phase dependence of the cross sections is discussed. (JFP)

7619 (ITP-74-166E) DIPOLE POMERON AND STRUCTURE IN pp-SCATTERING. Jenkovszky, L. L.; Wall, A. N. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1974. 11p. Dep. NTIS (US Sales Only) $4.00.

A dipole Pomeron model is applied to high energy pp-scattering. It is shown that the model reproduces both: the dip structure in the differential cross section and the break in the slope at small t. (auth)

7620 (JINR-1-7826) STUDY ON THE DOUBLE PRODUCTION OF THE DELTA-1236 RESONANCE IN THE $np \to np\pi^+\pi^-$ REACTION IN THE ENERGY RANGE FROM 2 TO 10 GeV. Gasparyan, A. P.; Kopylova, D. K.; Nikitin, A. V.; Troyan, Yu. A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1974. 14p. (In Russian). INIS.

The mechanism for the formation of the double isobar Δ_{1236} in the reaction $np \to np\pi^+\pi^-$ was examined in detail in the energy region from 2 to 10 GeV. It was shown that the existence of the exotic exchange for formation of Δ^{++} is due to the kinematic reverberations of the processes of formation and subsequent decay into Δ^{++} and π^- meson of the heavy isobar with maximum in the area of 1500 to 1700 MeV/c^2. (tr-auth)

7621 (ORO-4856-7) FIELD-THEORETIC LOW EQUATION APPROACH TO PION-NUCLEUS SCATTERING. Cammarata, J. B.; Banerjee, M. K. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy). Apr 1975. 30p. Dep. NTIS $4.50.

From the pion-nucleus Low equation in the one-meson approximation one obtains an uncoupled, nonlinear, singular integral equation to determine the crossing symmetric elastic pion-nucleus scattering amplitude. The driving term of this equation is evaluated in impulse, single-scattering approximation for (J/sup pi/ equals 0^+, I equals 0) ground state nuclei. It is found that unitarity requires that one include the effects of the strong absorption of the low partial waves in the entrance and exit channels. Thus, one introduces distortion of the pion waves by a procedure used in the inelastic peripheral scattering of elementary particles. Numerical results are presented for the iterative solution of this equation for pi-^{12}C scattering in the energy region of the (3,3) resonance. (auth)

7622 (RRK-73-14) THE THEORY OF FINITE DEGREE OF FREEDOM AND THE STRUCTURE OF NUCLEONS. Tati, T. (Hiroshima Univ., Takehara (Japan). Research Inst. for Theoretical Physics). Jul 1973. 16p. INIS.

In each stratum of Nature, the extension of matter has some important meaning characterizing the physical theory which has exploited the stratum. The extension of a nucleon is the property of the pion cloud around a core-called "nucleonic nucleus" — predicted by Yukawa's meson theory. The theory of hadronic matter gives the extended structure of the nucleonic nucleus, introducing basic particles and a constant having the dimension of length and relating to the property of the basic particles. The constituting particle is represented by a point in space. The degree of freedom of the particle is represented by a point. Meanings of point and divergence are explained in chapter 2. The relativistic theory is described by an infinite set. Finiteness principle and the theory of finite degree of freedom are discussed. The generalization of the usual field theory is described by "non-spatio-temporal description." The extended matter made of basic particles, such as the nucleonic nucleus, is called "hadronic matter." The model of the interaction between hadronic nuclei is discussed, and the interaction between nucleonic and mesonic nuclei is described. Finally, the structure of nucleons is explained, and the nucleon-pion interaction is derived. (JA)

7623 ELUSIVE ASYMPTOPIA. Jacob, M. (European Organization for Nuclear Research, Geneva). Comments Nucl. Particle Phys.; 6: No. 2, 31-40(Apr 1974).

The purpose is to give a general discussion on the reported continuous rise of total cross section in particle interactions at ISR energies. This is contrasted with the behavior at ordinary accelerator energies, where all cross sections appear to tend towards limiting values. It requires ISR energies ranging up to 2000 GeV in equivalent accelerator energy to see a definite rise of total cross section for pp interactions. A rise of the order of 10% across the ISR energy range was reported, although this is not universally agreed. Several experimental questions need to be studied more thoroughly. The rise of cross section is discussed in relation to other observable quantities. (27 references) (UK)

7624 ON REGGEIZED ABSORPTION IN THE PRESENCE OF THE SHIELDED FIXED-POLE POMERON. Fujisaki, H. (Rikkyo Univ., Tokyo (Japan). Dept. of Physics). Progr. Theor. Phys. (Kyoto); 52: No. 2, 596-601(Aug 1974).

By the use of the double-partial-wave formalism, the structure of absorptive Regge singularities is examined in the case of the fixed simple pole Pomeron with Arnold and Barnett's shielding-cut mechanism. It is shown that the full partial wave amplitude contains a moving branch cut of (inverse-)square-root type in relation to the $\pi\pi$-($\bar{K}K$-)shielding branch cut, in addition to a fixed branch cut of logarithmic type, that the physical partial wave amplitude has the particle pole with the increased residue and that the asymptotic behavior of the full Reggeonic amplitude is controlled by the input Regge pole at least in the neighbourhood of $t = 0$. (auth)

7625 OBSERVABLE EFFECTS OF THE LOWEST T-CHANNEL STATES. Pajares, C.; Pascual, R.; Trias, A. (Univ., Barcelona). Lett. Nuovo Cim.; 12: No. 13, 492-496(29 Mar 1975).

It is shown that 2π exchange is very important in particle-nuclei scattering, mainly for small nuclei. For these nuclei, a break in their differential cross section is predicted. The contribution of the lowest mass t-channel state (3π) is calculated by imposing unitarity constraints on the ω trajectory. (2 figures) (SDF)

7626 TWO-COMPONENT MODEL BASED ON THE STOCHASTIC PROCESS AND MULTIPARTICLE PRODUCTION. Toda, A.; Nakamura, H. (Tohoku Univ., Sendai). Lett. Nuovo Cim.; 12: No. 13, 497-502(29 Mar 1975).

A stochastic two-component approach to multiparticle production is described, taking into account the effect of the reactions $\pi \to \pi + \pi$ on the pionization process. Multiplicity distributions are calculated and compared with the data of inelastic pp collisions in the energy range above 50 GeV. The curves are well fitted to the experimental data. (5 figures) (SDF)

7627 PARITY-VIOLATING NNρ VERTEX AND FIELD ALGEBRA. Perez, M. A. Lett. Nuovo Cim.; 12: No. 17, 692-696 (26 Apr 1975).

A previous proposal for the parity-violating NNρ vertex is studied for the nature of the seagull and Schwinger terms in the space-time structure of the time-ordered product $T^*(V_\mu^\alpha(x) V_\nu^\beta(y) A_\lambda^\gamma(z))$, where V_μ^α and A_μ^α are the familiar SU(3) currents. The problem of constructing the covariant time-ordered product $T^*(V_\mu^\alpha V_\nu^\beta A_\lambda^\gamma)$ and the general conditions under which seagull and space-time cancel in the Ward-Takahashi identities for the T^* product are discussed. (JFP)

Particle Invariance Principles and Symmetries

General

7628 (IC-74-52) POSSIBILITIES FOR A NOVEL ALGEBRAIC APPROACH TO SYMMETRY BREAKING. Ktorides, C. N. (International Centre for Theoretical Physics, Trieste (Italy)). Jun 1974. 19p. INIS.

A nonassociative algebraic construction is introduced which bears a relation to a Lie algebra L paralleling the relation between an associative enveloping algebra and L. The analog of the Poincaré-Birkoff-Witt theorem is proved for the new algebra and a corresponding Gell-Mann-Okubo-like mass formula for an SU(3) octet is derived. Some suggestions and/or speculations are outlined as to possible applications of these new algebraic constructions, especially in connection with descriptions customarily ascribed to symmetry breaking. (auth)

7629 (ITP-74-141E) REPRESENTATIONS OF LIE GROUPS U(n,I), IU(n) AND THEIR ALGEBRAS. I. Klimyk, A. U.; Shirokov, V. A. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1974. 40p. Dep. NTIS (US Sales Only) $5.00.

There is obtained the classification of all irreducible quasi-simple representations (with accuracy up to the infinitesimal equivalency) for the group U(n,I) and the classification of irreducible representations of Lie algebra of the inhomogeneous unitary group IU(n) for which the restriction to the subalgebra u(n) with Lie group U(n) is decomposed into a direct sum of the finite-dimensional irreducible representations of the subalgebra u(n) which can be continued to unitary representations of the group U(n); each of irreducible representations of u(n) is contained in the decomposition with not more than finite multiplicity. (auth)

7630 CONTACT TRANSFORMATIONS AND CONFORMAL GROUP. II. Non-Relativistic Theory. Boya, L. J.; Cervero, J. M. (Zaragoza Univ., Spain). Int. J. Theor. Phys.; 12: No. 1, 55-60 (Jan 1975).

The contact group of nonrelativistic accelerated systems is found. A comparison with the relativistic situation is made. (auth)

Applications (Electromagnetic and Weak)

7631 (DESY-75/08) BETHE SALPETER EQUATION AND THE RELATIVISTIC QUARK MODEL. Eisenschitz, T. S. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (F. R. Germany)). Apr 1975. 27p. Dep. NTIS (US Sales Only) $5.50.

The SU(6) symmetry breaking inherent in relativistic quark models is described by using a solution of the Bethe Salpeter equation including spin Wigner rotations. Electroproduction matrix elements are calculated, and effects of changing the parameters investigated. (auth)

7632 TRANSITION TO CP CONSERVATION AND ZERO CABIBBO ANGLE IN STRONG MAGNETIC FIELDS. Salam, A.; Strathdee, J. (Imperial Coll. of Science and Tech., London). Nature (London); 252: No. 5484, 569-571 (13 Dec 1974).

It is pointed out that it is conceivable that the charge asymmetry associated with CP violation in $K_1^2 + 1 + (\ )$ decays may disappear for magnetic fields of $\sim 8 \times 10^{10}$ gauss if CP violation is very weak in character, and that the Cabibbo angle may be reduced to zero, leading to suppression of certain hyperon decays, in fields of the order of 10^{16} gauss. These estimates are, however, very strongly model-dependent, and it may be worthwhile to make a systematic phenomenological search for effects of string magnetic fields on particle asymmetries. (UK)

Applications (Strong)

7633 ANGULAR MOMENTUM IN TENSOR REPRESENTATIONS OF U(3). Green, H. S.; Bracken, A. J. (Univ. of Adelaide). Int. J. Theor. Phys.; 11: No. 3, 157-173 (Nov 1974).

The problem of labelling the representations of SO(3) contained in each representation of U(3) is solved by using for this purpose an operator Z with integral eigenvalues. A description is given of the decomposition of any tensor representation of U(3) into SO(3)-irreducible tensors labelled by these eigenvalues. An implicit definition of Z is given in terms of the U(3) generators, and the relation of Z to the labelling operators (with irrational eigenvalues) proposed by Racah (Group Theoretical Concepts and Methods in Elementary Particle Physics, Gordon and Breach, N. Y. (1962)) and others is made clear. A possible application to a quark model of the hadrons is described. (auth)

7634 IRREDUCIBLE REPRESENTATIONS OF SUPERSYMMETRY COMBINED WITH SU_N. Grosser, D. (Univ., Tuebingen, Ger.). Lett. Nuovo Cim.; 12: No. 17, 649-652 (26 Apr 1975).

In order to classify the hadrons into supermultiplets one has to find the irreducible representations of the supersymmetry algebra. It is shown that one obtains all irreducible representations of the internal symmetry SU(N) by applying the construction of Salam and Strathdee to all irreducible representations of SU(2) × SU(N). (JFP)

Scattering Theory

Refer also to abstracts 7536 and 7940.

7635 (IC-74-37) NEW MODEL OF REGGE CUT. Chia, S. P. (International Centre for Theoretical Physics, Trieste (Italy)). May 1974. 6p. INIS.

It is demonstrated that, in a model for calculating the Regge cut based on the Mandelstam diagram, structure for the cut richer than the absorption model is obtained even with a simple-minded pomeron. (auth)

7636 (ITP-74-42E) WEAK ASYMPTOTIC EXPANSION OF COEFFICIENT FUNCTIONS AT INFINITE VOLUME. Ivanov, S. S. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1974. 20p. Dep. NTIS (US Sales Only) $4.00.

Using the euclidean model $g(:\varphi^\mu:)_2$, weak equations of the resolvent type are deduced for the coefficient functions of scattering matrix. It is proved that the series of perturbation theory within an infinite volume can be considered to be asymptomatic in the sense of weak convergence. (auth)

7637 (ITP-74-107E) ANGULAR MOMENTUM REDUCTION IN THE FOUR-BODY PROBLEM. Kharchenko, V. F.; Shadchin, S. A. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1974. 35p. Dep. NTIS (US Sales Only) $4.75.

A complete angular momentum analysis of the integral equations of motion for four identical spinless particles is given. After separation of the variables associated with rotation of the system as a whole, the equations of motion take the form of an infinite set of coupled integral equations in three continuous variables. In general, the four-particle kinematic factors in the integral kernels are expressed as bilinear combinations of factors of the three-particle kinematic factor type. For the case of a separable two-particle interaction the equations obtained are simplified so that they are reduced to coupled integral equations in two continuous variables. (auth)

7638 (ITP-74-131E) REDUCTION FORMULA IN GENERAL BOGOLYUBOV'S AXIOMATIC APPROACH. Sabad, E. P.; Lomsadze, Yu. M.; Agranovskii, B. A. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1974. 15p. Dep. NTIS (US Sales Only) $4.00.

General Bogoliubov's axiomatic approach is considered in which the axiom on existence of the extended variable $\hat{S}$-operator $\hat{S}[g(x)]$, is conserved and even weakened, but no additional assumptions on the belonging of coefficient functions of the $\hat{S}$-operator to any certain class of functionals are made. A rigorous derivation of the reduction formula for the binary reaction amplitude is given. The derivation is essentially based on the result of the previous work on representability of the $\hat{S}$-operator in the strong normal form. (auth)

7639 (ITP-75-3E) SUBSTANTIATION OF THE HARTREE-FOCK METHOD FOR BOSE- AND FERMI-SYSTEMS. Simenog, I. V. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1975. 8p. Dep. NTIS (US Sales Only) $4.00.

A simple proof for adequacy of the Hartree-Fock solutions as asymptotically exact solutions for many-body systems with pair monotonic attractive potentials is given. (auth)

7640 (JINR-P2-8682) COVARIANT QUASIPOTENTIAL FORMALISM FOR TWO-PARTICLE BOUND STATE REACTIONS. Kotsinyan, A. M. (Joint Inst. for Nuclear Research, Dubna

(USSR)). 1975. 21p. (In Russian). Dep. NTIS (US Sales Only) $4.25.

Covariant quasipotential approach for two-particle bound state with one constituent on mass shell is considered. The possibility of describing reactions involving two-particle bound states in terms of a nonrelativistic wave function is discussed. An example of a soluable model is given, and on its basis the Fermi-motion effect is considered. (auth)

7641 (JINR-P4-8475) HIGH-ENERGY POTENTIAL SCATTERING THEORY AND THE PHASE FUNCTION METHOD. Khankhasaev, M. Kh. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 17p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The eikonal approximation for the amplitude in the potential scattering theory is analyzed on the basis of a new approach which is a natural generalization of the phase function method. The main equations of the theory are derived and analyzed. (auth)

7642 (JINR-P4-8580) INTEGRAL EQUATION FOR THE WAVE FUNCTION OF THREE IDENTICAL PARTICLES IN THE BOUNDARY CONDITION MODEL. 1. Two-Particle Problem. Schroedinger and Faddeev Equations for Three Particles. Efimov, V. N. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 17p. (In Russian). Dep. NTIS (U. S. Sales Only) $4.00.

It was shown that in the boundary condition model the off-shell t-matrix can be obtained based on the boundary conditions imposed on the wave function without introducing any concrete potential form. The Faddeev equations are written for three particles in the form from which there follow immediately the boundary conditions for the three-particle wave function. (auth)

7643 (JINR-P4-8640) EXAMPLE OF THE RECONSTRUCTION OF A POTENTIAL USING RESONANCE POSITIONS ONLY. Zakhar'ev, B. N.; Rudyak, B. V.; Suz'ko, A. A.; Ushakov, I. B. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 13p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

For the symmetrical potential $v(x) = v(-x)$ the set of R-matrix resonances consists of the spectra $\{E_n^I\}$ and $\{E_m^{II}\}$ of two auxiliary eigenvalue problems for the same Schrödinger equation. Two such spectra are sufficient for determination of $v(x)$. (auth)

7644 (JINR-P4-8744) QUASICLASSICAL SCATTERING AMPLITUDE IN THE HIGH-ENERGY APPROXIMATION. Lukyanov, V. K. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 16p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The formulas of Glauber and Schiff for the scattering amplitude in the region of dynamically small and large angles were generalized using the three-dimensional semi-classical method and the high energy approximation. (auth)

7645 (JINR-P11-8701) QUASISTATIONARY STATES CALCULATED WITHIN THE PHASE EQUATIONS IN THE R-MATRIX SCATTERING THEORY. Zhidkov, E. P.; Puzynin, I. V.; Yamaleev, R. M. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 16p. (In Russian). Dep. NTIS (US Sales Only). $4.00.

A method was presented to numerically solve the problem of determination of the quasi-stationary states for the radial Schroedinger equation in the framework of the R-matrix theory. The phase equation system was used when constructing the algorithm. The nonlinear functional equation obtained is solved on the basis of the continuous analog of the Newton method. (auth)

7646 VARIATIONAL METHODS WITH TRIAL FUNCTIONS NOT SATISFYING PRESCRIBED BOUNDARY CONDITIONS. Hennell, M. A.; Hendry, J. A. (Univ. of Liverpool). J. Phys., A (London); 8: No. 3, 229-312(Mar 1975).

Some variational methods are considered in which the trial functions used are not required to satisfy prescribed boundary conditions. Applications of these methods are made to a two-body system interacting via a hardcore potential. (auth)

7647 SOLUBLE MANY-CHANNEL SCATTERING PROBLEM. McKellar, B. H. J. (Melbourne Univ., Parkville, Australia). J. Phys. G: Nucl. Phys.; 1: No. 2, 180-194(21 Feb 1975).

A many-channel scattering problem with a separable interaction is described, and its exact solution is obtained. This solution is then used to discuss various effects in nuclear physics. (auth)

7648 GENERALIZED OPTICAL THEOREM IN COHERENT SCATTERING. Li, M. C. (Virginia Polytechnic Inst. and State Univ., Blacksburg). Phys. Rev., A.; 11: No. 3, 1101-1102(Mar 1975).

It is shown that the generalized optical theorem in quantum mechanics is a useful theorem in the scattering of two coherent beams. (auth)

7649 SELF-REPRODUCING j-PLANE SINGULARITIES. Andreev, I. V. (Lebedev Inst. of Physics, Moscow). Yadern. Fiz.; 21: No. 1, 171-181(Jan 1975). (In Russian).

Self-reproducing j-plane singularities are studied from general point of view. The convolution of partial wave amplitudes is calculated for the case of Schwarz type trajectories and necessary condition of self-reproducibility is found. New types of self-reproducing singularities are presented and some general features of such singularities are discussed. (auth)

7650 SUCCESSIVE APPROXIMATIONS FOR A TIME DEPENDENT SCATTERING PROCESS. Pao, C. V. (North Carolina State Univ., Raleigh). J. Math. Anal. Appl.; 49: No. 3, 545-560 (Mar 1975).

The treatment of successive approximations for a time dependent scattering process covers questions of the well posed problem and the method of construction of a solution for a more general system of initial boundary value problems. (JFP)

7651 SOMMERFELD-WATSON REPRESENTATION WITHOUT POLES. Azzarelli, T. (Xonics Inc., Van Nuys, CA); Collas, P. Lett. Nuovo Cim.; 12: No. 16, 601-604(19 Apr 1975).

A new presentation of the scattering amplitude is presented which is believed should be useful in the phenomenological analysis of the results of high energy scattering experiments and more generally yield some insight into other theoretical aspects of scattering. It turns out that by using parabolic instead of spherical coordinates the natural expansion for the scattering amplitude is a power series in variable $\tau = (1 - \cos\theta)/(1 + \cos\theta)$. One is concerned with an integral representation which is related to the above power series in the same way the Regge representation is related to the partial wave series. Only relevant results are presented. (JFP)

7652 RESONANCE-POLE SEPARABLE APPROXIMATION TO OFF-SHELL AMPLITUDE. Vitturi, A.; Zardi, F. (Univ. Padua). Lett. Nuovo Cim.; 12: No. 16, 645-648(19 Apr 1975).

The problem of resonance-pole separable approximation to the off-shell amplitude is considered in the framework of the direct parametrization of the S matrix in terms of its poles, and is developed on the basis of the Green function approach to this theory. This derivation is confined to potentials that vanish beyond a fixed radius. (JFP)

PHYSICS (LOW-TEMPERATURE)

Superfluidity

7653 (CONF-750120-1) SOUND PROPAGATION IN NORMAL AND SUPERFLUID ^{3}He. Ketterson, J. B.; Roach, P. R.; Abraham, B. M.; Roach, P. D. (Argonne National Lab., Ill. (USA)). 1975. Contract W-31-109-Eng-38. 43p. Dep. NTIS $5.25.

From 54th annual meeting of transportation research board; Washington, District of Columbia, USA (16 Jan 1975).

Measurements are presented of the pressure dependence of the attenuation and velocity of sound in the hydrodynamic regime and in both the normal and superfluid zero sound regime of ^{3}He. The velocity and attenuation were studied at a frequency of 20.24 MHz and at pressures of 17.00, 21.00, 21.50, 21.80, 22.00, 23.17, 26.00, and 28.00 bar in the zero sound regime. In the hydrodynamic region the temperature dependence of the attenuation was studied at 5.48 and 10.02 MHz and at pressures of 0.69, 1.38, and 2.76 bar. At a pressure of 29.3 bar and frequency of 20.24 MHz the transition from hydrodynamic to zero sound behavior was studied for both the velocity and attenuation. In addition, the anisotropy of the velocity and the attenuation as a function of the angle between the direction of an applied external magnetic field and the sound propagation direction was observed in the superfluid A phase at a pressure of 26.0 bar; no anisotropy was observed in the B phase at 21.0 bar. The observed behavior associated with a collective excitation of the order parameter in the B phase is shown to be qualitatively in agreement with theoretical predictions. At pressures slightly above the polycritical point some unexplained structure is observed in the velocity near the AB transition. (auth)

7654 (IC-74-84) GAUGE THEORY OF SUPERFLUIDITY. Chela Flores, J. (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1974. 17p. INIS.

A gauge theory of superfluidity in ^{4}He II is studied. An illustration of how the gauge principle leads to a meaningful low-temperature theory is given. Then the field equations are inferred and studied, writing them down in their hydrodynamical form. Applications to some simple hydrodynamical problems are considered. (auth)

7655 ANISOTROPIC SOUND ABSORPTION IN THE ANDERSON–MOREL PHASE OF SUPERFLUID ^{3}He. Seiden, J. (Paris-11 Univ., 91 - Orsay (France). Inst. d'Electronique Fondamentale). Compt. Rend., Ser. A, B; 279: No. 21, 519-521 (18 Nov 1974). (In French).

The absorption coefficient of the first sound in a single domain of the A phase of superfluid ^{3}He is determined as a function of its direction of propagation. (FR)

7656 ISOTOPICALLY PURE ^{4}He. Fatouros, P. P.; Edwards, D. O.; Gasparini, F. M.; Shen, S. Y. (Ohio State Univ., Columbus). Cryogenics; 15: No. 3, 147-148(Mar 1975).

A method of obtaining pure ^{4}He from commercial ^{4}He by filtering it through a superleak is described. Helium obtained by this method has been analyzed by mass spectrometry and contained 0.4 ± 0.2 parts per billion of ^{3}He and the purity has been estimated to be better than 50×10^{-9}. (UK)

7657 SUPERFLUIDS AND STOCHASTIC ELECTRODYNAMICS. Surdin, M. (Univ. Bordeaux, Talence, France). Lett. Nuovo Cim.; 12: No. 6, 171-174(8 Feb 1975).

By using strictly classical arguments and the concept of the universal fluctuating electromagnetic field at the absolute zero of temperature, the zero-point field, a modified Schroedinger equation was derived. A program of application of this formalism to various problems was initiated with the purpose of reviewing in the framework of stochastic electrodynamics and when possible, complementing quantum-mechanical results. Superconductors are considered; some of the arguments, however, are applicable to superfluids in general. (MHR)

7658 POSITIVE IMPURITY IONS IN SUPERFLUID HELIUM. Johnson, W. W. New Brunswick, NJ; Rutgers — The State Univ. (1974). 75p. University Microfilms Order No. 75-8405.

Thesis (Ph. D.).

A technique for introducing a wide variety of positive ions into liquid helium is described and used to investigate positive atomic ions of K, Rb, Cs, Ca, Sr, and Ba. The zero-field mobility of the impurity ions was measured in He II in the temperature range 1.2 less than T less than 1.4 K. The dependence of mobility on ion mass alone was found directly for Ca by investigating two isotopes. Measurements were made of the ion drift velocities in high electric fields, where the interaction with quantized vortex rings is important. All the data and its analysis are consistent with the assumptions that all the impurity ions are singly-charged, that the size of the cluster surrounding the ion is significantly different for the different ions, and that the ion-roton cross-section is approximately geometrical. (Diss. Abstr. Int., B)

7659 LIGHT SCATTERING FROM BOUND ROTON PAIRS IN He II. Kobe, D. H.; Cheng, S. T. (North Texas State Univ., Denton). J. Low Tem. Phys.; 19: No. 5/6, 379-396(Jun 1975).

The cross section for light scattering from superfluid helium in which bound roton pairs are created is calculated in a simple model, taking into account both the excitations themselves and their coupling to the light. It is shown that the depolarization ratios from bound and from noninteracting roton pairs are the same, in agreement with experimental values. Since the continuum (scattering) states for the interacting pairs are neglected here, the bound roton pairs give only a delta-function line shape, in contrast to the noninteracting roton pairs. (auth)

7660 INTENSITY, CORRELATION, AND STATISTICS OF RAYLEIGH-SCATTERED LIGHT NEAR THE GAS—LIQUID CRITICAL POINT OF ^{3}He. Ohbayashi, K.; Ikushima, A. (Tokyo Univ.). J. Low Temp. Phys.; 19: No. 5/6, 449-465(Jun 1975).

The intensity, correlation, and statistics of Rayleigh-scattered light were measured near the gas-liquid critical point of ^{3}He along the coexistence curve and the critical isochore in the temperature region 10^{-5} less than parallel bar epsilon parallel bar less than 4×10^{-2} (epsilon identical with parallel bar T–T/sub c/ parallel bar/T/sub c/). From the intensity measurements, the following critical parameters have been obtained: gamma equals 1.14 ± 0.05, v equals 0.59 ± 0.04, and ξ_0 equals 4.8 ± 2A for T greater than T/sub c/ (along the critical isochore); gamma' equals 1.16 ± 0.07, nu' equals 0.68 ± 0.07, and xi/sub +/ equals 4.3 ± 3.2A for T less than T/sub c/ (liquid phase along the coexistence curve); and χ_0/chi/sub +/ equals 3.6 ± 0.4. From the correlation measurements, the total thermal diffusivity along the critical isochore in the hydrodynamic region has been determined to be D/sub T/ equals (1.57 ± 0.10) x 10^{-4} epsilon/sup 0.68 ± 0.03/cm^2/sec. The temperature and wave-vector dependence of the singular part of the Rayleigh linewidth has been shown to fit Kawasaki's modified expression with the parameters χ_0 equals 3.3 epsilon$^{-0.39}$ A and eta equals 13(1.15 + 3.19 x 10^{-2} ln epsilon)$^{-1}$ mu P. The statistics of the critical fluctuation have been found to be Gaussian. (auth)

Superconductivity

Refer also to abstracts 7002, 7036, 7038–7041, 7120, 7130, 7131, 7205, 7220, and 7657.

7661 (CONF-740997-2) PEAK EFFECT AND FLUX FLOW. Kramer, E. J. (Argonne National Lab., Ill. (USA)). 1974. 23p. Dep. NTIS $4.25.

From international meeting on flux pinning in superconductors; Sonnenberg, F.R. Germany (23 Sep 1974).

The interpretation of voltage-current (V-I) curves in terms of FLL motion and the concept of a dynamic pinning force are discussed and a recent discrete lattice model of this pinning force and related experiments are reviewed. The conditions necessary for the appearance of the "regular" and "irregular" peak effect are investigated and variants of the FLL shear elasticity model of Pippard for the latter are discussed. Experimental observations of the disappearance of FLL history effects above the peak, the abrupt change in V-I characteristic at the peak and the shift and broadening of the peak with increasing pin density and strength all favor such a model over models in which the peak is attributed to a peak in the elementary pinning force. (auth)

7662 ULTRASONIC ATTENUATION IN SUPERCONDUCTORS: THEORY OF THE EFFECT OF SCATTERING OF ELECTRONS BY THERMAL PHONONS. Forgan, E. M. (Univ. of Birmingham, Eng.). J. Phys., F (London); 5: No. 3, 515-527 (Mar 1975).

The theory and the results of numerical calculations are presented of the effect on ultrasonic attenuation in superconductors of the scattering of conduction electrons by phonons. A Debye phonon spectrum and a spherical Fermi surface are assumed for the purpose of explicit calculation, but the effects described are expected to occur in all pure superconductors with a high enough T_c. Both at small ql (q is sound wave-vector and l is

electron mean free path), and over a range of ql greater than unity, thermal phonons have a marked effect on the relaxation of the electrons in the superconducting state, but not in the normal state. Thus the BCS relationship for the ultrasonic attenuation ratio between superconducting and normal states, which is applicable when impurity scattering of electrons is dominant, no longer applies when scattering of electrons by thermal phonons becomes important. The existing experimental data agree qualitatively with theory, but there is insufficient detail in the data to provide a thorough comparison. (auth)

7663 DIMENSIONALITY OF EXTREMELY THIN SUPERCONDUCTING FILMS. Sixl, H.; Sanwald, W. (Univ., Stuttgart). Solid State Commun.; 16: No. 5, 603-605(1 Mar 1975).

Superconducting fluctuations above the transition temperature are strongly dependent on the dimensionality of the samples. Experiments on extremely thin quench condensed aluminium films show transitions from zero- to one-, two- and three-dimensional behavior at an average film thickness of 20, 50 and 100 Å respectively. (auth)

7664 ENERGY SPECTRUM OF EXCITATIONS IN TYPE-II SUPERCONDUCTORS. Mints, R. G.; Rachmanov, A. L. (Inst. of High Temperatures, Moscow). Solid State Commun.; 16: No. 6, 747-750(15 Mar 1975).

The quasi-classical approximation has been applied in order to study the energy spectrum of the bound excitations with the radial quantum number $n \neq 0$ in the isolated vortex line core in a pure type-II superconductor. The qualitative estimations of the number of levels and the numeric calculations of the spectrum for the special form of potentials $A_\Theta(r)$ and $\Delta(r)$ have been made. (auth)

7665 COHERENT FLUX FLOW IN SUPERCONDUCTING FILMS WITH PERIODICALLY MODULATED THICKNESS. Daldini, O.; Leeman, C.; Martinoli, P. (Eidgenoessische Technische Hoechschule, Zurich). Solid State Commun.; 16: No. 5, 509-513(1 Mar 1975).

An anomalous behavior is found of the flux flow characteristics of superconducting films with modulated thickness when the vortex lattice matches the periodic pinning structure. At a matching field there is a voltage rise associated with a decrease in supercurrent which is usually not observed for random pinning. Coherent motion of the vortex lattice is responsible for this behavior. Structure in the differential flux flow resistivity as a function of current can be related to harmonic components of the periodic pinning potential. A recent theory by Schmid and Hauger (J. Low Temp. Phys.; 11: 667(1973)) may be extended to give a satisfactory description of the experiments. (auth)

7666 TOTAL ENTROPY DENSITY OF A GENERAL SUPERCONDUCTOR. Kirschner, I.; Martinas, K.; Toros, R. (Roland Eotvos Univ., Budapest). Acta Phys. Acad. Sci. Hung.; 37: No. 1-2, 17-29(1974).

Characterizing the energetic, electric and magnetic interactions occurring in superconductivity by means of the method of extensive and intensive parameters, the total entropy density of a general superconductor has been determined. The resulting formula contains all possible superconducting effects and describes them separately with an additive term for each. The fundamental equation obtained can be applied for the individual special superconducting states by taking into consideration the particular terms corresponding to them. (auth)

7667 HIGH-FREQUENCY BEHAVIOR OF THE AMPLITUDE OF A NONSTATIONARY JOSEPHSON CURRENT. Malinovskii, L. L. JETP Lett.; 20: No. 8, 250-251(20 Oct 1974).

Translated from Zh. Eksp. Teor. Fiz., Pis'ma Red.; 20: No. 8, 548-551(20 Oct 1974).

The spectrum of the elementary excitations in a superconductor is determined in a frequency region not confined to the Debye region. The spectrum is used to calculate the spectral characteristics of the Josephson tunnel current. (auth)

7668 MAGNETIC PROPERTIES OF SUPERCONDUCTORS WITH UNIAXIAL SYMMETRY. Takanaka, K. (Max-Planck-Institut fuer Metallforschung, Stuttgart). Phys. Status Solidi B.; 68: No. 2, 623-631(1 Apr 1975).

In type-II superconductors with uniaxial symmetry the three critical fields (H_{c1}, H_{c2}, H_{c3}) are calculated near the transition temperature T_c using the anisotropic Ginzburg-Landau equations. It is shown that in general an induced magnetic field $\Delta H_\perp$ perpendicular to the applied magnetic field exists and that the anisotropy removes the degeneracy in the direction of the flux-line lattice. The pattern and the orientation of the flux-line lattice are in good agreement with the experimental results of technetium. (auth)

7669 THERMODYNAMICS OF SUPERCONDUCTING MAGNETIC ALLOYS IN THE WEAK COUPLING THEORY. Lam, J. (Dikewood Corp., Albuquerque, NM). J. Low Temp. Phys.; 19: No. 5/6, 467-480(Jun 1975).

The thermodynamics of superconducting magnetic alloys is studied in the weak coupling theory presented in a previous paper. This theory describes the effect of magnetic impurity scattering by means of a constant conduction electron lifetime. The variation of the superconducting order parameter with the pair-breaking parameter and the temperature is obtained numerically. The free energy, the critical magnetic field, the entropy, and the electronic specific heat are calculated. The critical magnetic field at zero temperature is found to decrease linearly with increasing impurity concentration. The specific heat varies linearly with temperature at near-zero temperatures, due to a finite density of states at the Fermi level. (auth)

7670 COMPARISON OF METHODS FOR MEASURING FLUX GRADIENTS IN TYPE II SUPERCONDUCTORS. Kroeger, D. M.; Koch, C. C.; Charlesworth, J. P. (Oak Ridge National Lab., TN). J. Low Temp. Phys.; 19: No. 5/6, 493-512(Jun 1975).

A comparison has been made of four methods of measuring the critical current density J/sub c/ in hysteretic type II superconductors, having a wide range of K and J/sub c/ values, in magnetic fields up to 70 kOe. Two of the methods, (a) resistive measurements and (b) magnetization measurements, were carried out in static magnetic fields. The other two methods involved analysis of the response of the sample to a small alternating field superimposed on the static field. The response was analyzed either (c) by measuring the third-harmonic content or (d) by integration of the waveform to obtain a measure of flux penetration. The results are discussed with reference to the agreement between the different techniques and the consistency of the critical state hypothesis on which all these techniques are based. It is concluded that flux-penetration measurements by method (d) provide the most detailed information about J/sub c/ but that one must be wary of minor failures of the critical state hypothesis. Best results are likely to be obtained by using more than one method. (auth)

PHYSICS (NUCLEAR)

7671 (AEC-tr-7297/1) UKRAINIAN PHYSICS JOURNAL. Translation of Ukr. Fiz. Zh. (Russ. Ed.); 16: No. 1, 1-164(Jan 1971). 215p. (TT-72-52017/01). Dep. NTIS $7.60.

A complete translation into English of the January 1971 issue of Ukrainskii Fizicheskii Zhurnal is given. Items within the subject scope of NSA were cited from the original language source. (RWR)

7672 (CONF-731229-P16B) PROCEEDINGS OF THE NUCLEAR PHYSICS AND SOLID STATE PHYSICS SYMPOSIUM, BANGALORE, DECEMBER 27-31, 1973. Volume 16B. Nuclear Physics. (Indian Inst. of Science, Bangalore). 1973. 343p.

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973).

Seventy-seven of the items in this volume, containing significant amounts of data, are title listed separately. An abstract was prepared for the single invited paper. In addition, nine items have already been cited in NSA with the following abstract numbers: 29: 08958, 29: 11532, 30: 11053, 31: 14236, 31: 17678, 31: 18473, 31: 18491, 31: 18492, and 31: 18617. (RWR)

For abstracts or titles of individual papers see: 6506-6512, 6548, 7262, 7279-7281, 7285, 7294-7296, 7691-7695, 7705, 7706, 7715-7720, 7736-7741, 7755-7758, 7770-7775, 7786-7789, 7797-7799, 7818-7823, 7847-7863, 7891, 7892, and 7925.

Neutron Interactions with Matter

Refer also to abstract 7902.

7673 (AD-783978) MEASUREMENT OF THE DIFFERENTIAL NEUTRON DOSE ALBEDO FOR IRON, SOIL, AND WATER. Kukhtevich, V. I.; Trykov, L. A.; Goryachev, I. V. Translated by C. M. Barber from Vop. Dozim. Zashch. Izluch., Mosk. Inzh. Fiz. Inst., Sb. Statei; No. 6, 13-19(1967). 17p. (FTD-HT-23-1507-74). NTIS $3.00.

7674 (CEA-N-1779) 200 GROUP DOPPLER EFFECT CALCULATION FOR THE ERMINE EXPERIMENT. Banifatemi, A.; Guyader, A.; Kavenoky, A. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Div. d'Etude et de Developpement des Reacteurs). Jan 1975. 29p. (In French). INIS.

Reactivity Doppler effect of uranium 238 was measured by the oscillation technique; the experiment was done in the sub-critical fast assembly ERMINE coupled to the thermal reactor MINERVE by a spectrum converter. A perturbation calculation was performed by the EXCALIBUR code. In the experimental cell, direct and adjoint heterogeneous fluxes have been computed; a surface source corresponding to fundamental flux was assumed as the boundary of the cell. The computations were done with 200 groups and refined self-shielding calculations were performed. The agreement between calculation and experiment is good. (FR)

7675 (COO-2280-17) INTERIOR CORNER PROBLEM FOR THE NEUTRON DIFFUSION EQUATION. Bareiss, E. H.; Vickery, S. R. (Northwestern Univ., Evanston, Ill. (USA). Technological Inst.). Nov 1974. Contract AT(11-1)-2280. 87p. Dep. NTIS $7.50.

The qualitative and quantitative behavior of the solution of the neutron diffusion equation at interior corners of two different materials is investigated. This is done by assuming regionwise constant coefficients and sources, reducing the problem to dimensionless form and solving the Neumann problem over a circular disk, The general analytic solution is given, as well as special solutions. A series of parameter studies have been made which include the extreme cases that can occur in neutron diffusion. The results including eigenvalues, eigenfunctions, Fourier coefficients and flux profiles are tabulated and presented in graphical form. It is shown how to select appropriate function spaces to obtain good numerical methods for coarse network calculations. (33 figures, 25 tables) (auth)

7676 (FRNC-CONF-122) PROBABILITY FOR NEUTRON CAPTURE BY A SMALL DIMENSION WATER TARGET. Ageron, P. (Institut Max von Laue - Paul Langevin, 38 - Grenoble (France)). 21 Aug 1974. 4p. (In French). INIS.

From 2nd international symposium on nuclear capture gamma-ray spectroscopy; Petten, Netherlands (2 Sep 1974).

Neutrons arriving on a water target can be captured in first collision with a probability p varying with the neutron speed, during diffusion in the target before escape. To calculate the latter probability the following assumptions are made: the target is spherical, its volume is that of the actual target, the incident neutrons are all diffused in first collision and create a uniform source S in the volume of the source. The diffusion equation is written. (FR)

7677 (NIRS-R-2, pp 97-99) THE ATTENUATION OF FAST NEUTRONS IN SEVERAL MATERIALS. Nishimura, A.; Maruyama, T.; Kato, Y. Nov 1973. (In Japanese).

In first report on the cancer therapy with high energy particles and the utilization of short lived radionuclides in diagnostics. (National Inst. of Radiological Sciences, Chiba (Japan)).

Monochromatic 18-MeV neutrons generated from deuterons in a tritium target with van de Graaff accelerator, and neutrons of 2 MeV average generated from deuterons in a beryllium target were used. Attenuation measurement was performed by adhering single and multiple layers of several materials closely to the steel shield surface protecting around the target, and placing gas-filled ionization chamber 70 cm apart from the target. Steel (S), polyethylene (Po), borated paraffin (BP), lucite, water in 10 mm thickness lucite case (W), concrete (C) and lead (L) were used as the shielding materials. In case of 2-MeV neutrons, W was found to be the best shielding material among S, lucite, Po and W, while S was not so good. Po (5 cm) + BP (10 cm) + L (5 cm) showed the best efficiency among multiple layers. In case of 18-MeV monochromatic neutrons, S and Po were more effective shielding materials than W and C, while S (15 cm) + {Po (5 cm) + S (5 cm)} × 3 was the most effective among multilayers. Further consideration was made concerning combination of borated wood, as boron had been reported to be excellent shielding material against low energy neutrons. (JA)

7678 (UCID-16728) COMPARISON OF CALCULATED AND EXPERIMENTAL NEUTRON SPECTRA FROM THE LLL PULSED SPHERE PROGRAM USING THE TART MONTE CARLO CODE AND THE LLL EVALUATED NUCLEAR DATA LIBRARY. Howerton, R. J. (California Univ., Livermore (USA). Lawrence Livermore Lab.). May 1972. Contract W-7405-eng-48. 37p. Dep. NTIS $5,00.

Several of the neutron spectra measured in the LLL pulsed sphere program have been calculated using the TART Monte Carlo neutronics code and the LLL Evaluated Nuclear Data Library. As a check of the TART code, the MCN code was run to calculate some of the same pulsed spheres as those calculated by TART. Within Monte Carlo statistics, the results were essentially identical. (28 figures) (SDF)

7679 (UCRL-50400(Vol.16)) INTEGRATED SYSTEM FOR PRODUCTION OF NEUTRONICS AND PHOTONICS CALCULATIONAL CONSTANTS. Volume XVI. Tabular and Graphical Presentation of 175 Neutron Group Constants Derived from the LLL Evaluated Neutron Data Library (ENDL). Plechaty, E. F.; Cullen, D. E.; Howerton, R. J.; Kimlinger, J. R. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 29 Jan 1975. Contract W-7405-Eng-48. 355p. Dep. NTIS $10.60.

As of February 3, 1975, 175 neutron group constants had been derived from the Evaluated Nuclear Data Library (ENDL) at LLL. In this volume, tables and graphs of the constants are presented along with the conventions used in their preparation. (auth)

7680 (WANL-TME-1498) STATUS REPORT ON THE B1T PROGRAM. Provides Thermal-Neutron Flux and Current Spectra, Isotropic and Anisotropic Group Cross Sections. Gibson, G.; Collier, G. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Aug 1966. 42p. Dep. NTIS $5.25.

A description of the program B1T is given that includes a brief discussion of how it differs from previous programs. A set of equations that provide for the calculation of the thermal neutron spectrum (fluxes and currents) in the P(1) and B(1) approximation consistent with the GAM type of calculation are presented along with the method of solution. (1 table) (SDF)

7681 (WANL-TMI-866) NE 8020 A: REVISION OF CRSAVE. Ortenberg, L. I. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 14 Nov 1963. 7p. Dep. NTIS $4.00.

Since the initial coding of the CRSAVE program, special problems have arisen which have required minor changes in the program. In order to treat these problems and to make the program more general and versatile, a recoding was performed. The details of the new input scheme and additional features of the program are briefly discussed. (SDF)

7682 (WANL-TMI-962) TRANSPORT CROSS SECTION IN THE GAM PROGRAM. Stevens, C. A. (Westinghouse Electric

Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 5 Feb 1964. 5p. Dep. NTIS $4.00.

The GAM computer program optionally prints out microscopic as well as macroscopic group averaged cross sections. A clarification of the group averaged microscopic transport cross section is provided. (SDF)

7683 (WANL-TMI-988) CORRESPONDENCE BETWEEN GAM AND DSN CROSS SECTIONS. Stevens, C. A. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 26 Feb 1964. 5p. Dep. NTIS $4.00.

An attempt is made to clarify the relationship between cross sections obtained from the GAM computer program and cross sections that are used in DSN. Notation is defined and differences are discussed. (SDF)

7684 SIMPLE EXPRESSION FOR EFFECTIVE NEUTRON TEMPERATURE DUE TO ROTATIONAL MOTIONS OF COLD-MODERATOR MOLECULES. Utsuro, M. (Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst.). J. Nucl. Sci. Technol. (Tokyo); 16: No. 10, 434-444(Oct 1974).

An analysis is presented on the slowing-down of cold neutrons in moderators in which molecular or intramolecular rotations play a predominant role. Use is made of two kinds of approximation: (1) the classical approximation in which the rotational effects are taken into account in terms of an effective mass, and (2) the few-level approximation which becomes useful at the lowest limits of temperature. Further, the concept of effective mass is extended to include also the effects of a weak hindering barrier against rotation. The expressions derived for the effective cold neutron temperature in low temperature moderators are compared with experimental results obtained on typical materials-condensed methane and methyl compound, and satisfactory agreement is obtained. The analysis further reveals some particular characteristics inherent in the slowing-down of cold neutrons due to the rotational motions of molecules. Moreover, the present model is found valid for expressing the slopes in the $1/\nu$-region presented by the scattering cross section of ammonium ions in low barrier materials. (auth)

7685 SOLUTION OF DIFFUSION EQUATION IN R-Z GEOMETRY BY FINITE FOURIER TRANSFORMATION. Kobayashi, K. (Kyoto Univ. (Japan). Faculty of Engineering). J. Nucl. Sci. Technol. (Tokyo); 11: No. 12, 561-570(Dec 1974).

It is shown that the monoenergetic diffusion equation in multi-region r-z geometry can be solved by the finite Fourier transformation method which has successfully been applied to x-y geometry. In this method, a system of linear algebraic equations is derived for Fourier coefficients of fluxes and currents at the material boundaries between regions of constant cross sections, and all the boundary values are determined by solving this equation. Numerical examples are presented for a problem featuring a fixed source and multiple regions, and the results are compared with those obtained from the current difference method. It is shown that the present method yields a better result with relatively few terms of expansion. (auth)

7686 APPLICATION OF THE GENERALIZED COLLISION PROBABILITY TO ANISOTROPIC DIFFUSION COEFFICIENT CALCULATION. Takeda, T. (Hitachi Ltd., Kawasaki, Kanagawa, Japan). Ann. Nucl. Sci. Eng.; 1: No. 9/10, 495-501(Sep 1974).

The effective diffusion coefficient in a cylindrical cell is calculated from the Benoist formula [CEA-R-2278(1964)] by applying the first-flight collision probability method in one-velocity. Following this formula, the diffusion coefficient is determined by a component of the tilted flux. The anisotropy and the space variation of the tilted flux are taken into account by using the Legendre expansion. The expansion coefficients are determined by the generalized first-flight collision probability. At the cell boundary, a new reflection condition is derived for the generalized collision probability instead of the usual isotropic reflection boundary condition. From numerical examples, it is seen that values of the radial diffusion coefficient calculated from the present method agree with those from the exact method in a square cell. Further, when the first term of the Legendre expansion is included, rapid convergence of the radial diffusion coefficient can be seen. (auth)

7687 SPECTRA OF THERMAL AND RESONANCE NEUTRONS IN A GRAPHITE CUBE. Odintsov, Yu. M.; Koshelev, A. S.; Malinkin, A. A. At. Energ. (USSR); 38: No. 4, 209-212 (Apr 1975). (In Russian).

The results of an experimental investigation of thermal and resonance neutrons in a graphite cube, the linear dimensions of which were 1 meter, are presented. The measurements were performed along the central axis of the cube directed toward a neutron source located at a distance of 3 meters from the front cube face. An assembly of ^{235}U (90%) metal having a spectrum close to the spectrum of fission neutrons served as the neutron source. For measuring, the reactions $^{115}In(n,\gamma)$, $^{197}Au(n,\gamma)$, $^{186}W(n,\gamma)$, $^{139}La(n,\gamma)$, $^{63}Cu(n,\gamma)$, $^{23}Na(n,\gamma)$, $^{37}Cl(n,\gamma)$ and $^{164}Dy(n,\gamma)$ were used. The neutron temperature was measured by means of a "double sandwich" of ^{155}Ga and ^{164}Dy isotopes. Measured spectra of intermediate neutrons have the form $1/E^{\alpha}$ in the interval from 1 eV to 1 keV. For distances of 4, 16, 28, and 41 cm from the front cube face, the values of α equal 0.84, 0.86, 0.93, and 0.96 and the neutron temperatures were 378 ± 22, 352 ± 21, 324 ± 19, and 319 ± 19 degrees Kelvin, respectively. (1 figure, 2 tables) (auth)

7688 NEUTRON SLOWING-DOWN TIME STUDIES IN IRON: MEASUREMENTS FROM 1.46 eV TO 847 keV. Rippon, J. P.; Scott, M. C. (Univ. of Birmingham, Eng.). J. Phys., D (London); 7: No. 18, 2525-2535(11 Dec 1974).

Two techniques are used to investigate time-dependent neutron behaviour in a large iron assembly. The first, covering the energy range from 1.4 to 132 eV, uses resonance absorbers in conjunction with either a Ge(Li) detector or a small BF_3 counter whilst the second, from 110 to 846 keV, uses inelastic scattering indicators with a Ge(Li) detector. The measurements in the eV region are compared with values calculated using a multigroup transport code. For those in the keV region corrections are applied for level lifetime and source burst width and comparison is made with the result of a preliminary calculation. (auth)

Nuclear Properties and Reactions, A ≤ 5

Refer also to abstracts 7768 and 7859.

7689 (CRN/HE-74-21) STUDY OF THE p,α INELASTIC CHANNELS. Application to the Calculation of d/α and $^3He/\alpha$ Ratios of the Cosmic Radiation. Jung, M. (Centre National de la Recherche Scientifique, 67 - Strasbourg (France). Centre de Recherches Nucleaires; Strasbourg-1 Univ., 67 (France)). 1974. 74p. (In French). INIS.

Production cross sections for d and ^3He particles emitted in 150 MeV α particle interactions with the nuclear emulsion hydrogen have been measured. A theoretical approach has been done, and an analytical representation of the differential cross section for the emitted d and ^3He particles studied. Such an analysis was performed in order to study the cosmic ray d and ^3He formation and propagation. So, it was possible to give an explanation for the measured d/α and $^3He/\alpha$ ratios according to the origin spectra, the mean life of particles in the galaxy, the solar modulation. (FR)

7690 (IC-73-164) SEPARABLE POTENTIAL FOR $\alpha-\alpha$ INTERACTION. Rahman, M.; Husain, D.; Ali, S. (International Centre for Theoretical Physics, Trieste (Italy)). Nov 1973. 8p. INIS.

A non-local separable interaction of Mongan type has been used to study S, D and G wave $\alpha-\alpha$ scattering-phase shifts up to bombarding energy of 24 MeV. Calculations have been made in the co-ordinate representation in which the Coulomb effects have been taken into account exactly. A separable representation of the $\alpha-\alpha$ interaction is found to be satisfactory. (auth)

7691 D-STATE ADMIXTURE IN π^0 PHOTOPRODUCTION FROM THE DEUTERON. Srinivasa Rao, K. (Inst. of Mathematical Sciences, Madras); Srinivasa Raghavan, S. pp 57-60 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Vol. 16B. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

7692 $p-^4He$ AND $p-^{16}O$ ELASTIC SCATTERING AT 1 GeV ENERGY. Pal, D.; Devi, S. (Saha Inst. of Nuclear Physics, Calcutta). pp 64-67 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Vol. 16B. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

7693 TRITON BINDING ENERGY FOR LOCAL SQUARE WELL POTENTIAL WITH FADDEEV APPROACH. Purkayastha, G.; Sil, N. C. (Indian Association for the Cultivation of Science, Calcutta). pp 87-90 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Vol. 16B. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

7694 FADDEEV–YACUBOVSKY MODEL OF FOUR-PARTICLE SCATTERING PROBLEM. Sharma, V. K. (Dept. of Physics, Aligarh, India). pp 104-106 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

7695 STUDY OF THE 20.3-MeV STATE IN ^{4}He BY THE CLUSTER MODEL. Jain, V. K.; Srivastava, B. B. (Meerut Univ., India). pp 122-125 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

Nuclear Properties and Reactions, $6 \leq A \leq 19$

Refer also to abstracts 7312, 7707, 7738, 7768, and 7859.

7696 (IPNO-TS-74-2) α PICK-UP CROSS SECTION VARIATIONS (^{3}He, ^{7}Be) ON EVEN–EVEN NUCLEI BETWEEN ^{12}C AND ^{40}Ca. Audi, G. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire; Paris-11 Univ., 91 - Orsay (France)). 1974. 63p. (In French). INIS.

Recent studies of the α pickup reactions on A = 4 n nuclei between ^{12}C and ^{40}Ca have shown a strong monotonous decrease of two orders of magnitude of the cross section, due to absorption. However, two nuclei, ^{32}S and ^{36}Ar, have been omitted yet, for serious experimental difficulties. This is studied here through the (^{3}He, ^{7}Be) pick-up reaction. It implies the design of two gas cells with thin entrance and exit foils, in order to minimize the straggling. The overall resolution is of about 250 keV. The first cell is used for angular distributions; the second one for measurements at two forward angles, 10 deg and 15 deg, and its volume is minimized for the use of the relatively expressive ^{36}Ar gas. An α pickup spectroscopic factor, Sα, is extracted from the cross sections, through a finite-range DWBA analysis, for nuclei ^{12}C, ^{16}O, ^{20}Ne, ^{28}Si, ^{32}S, ^{36}Ar and ^{40}Ca. It is concluded that the overall changes of Sα between ^{12}C and ^{40}Ca are moderate, but that local variations exist: Sα is lower in the middle of the (sd) shell and higher for ^{40}Ca. A comparison is tried between these results and the small amount of predictions coming from the shell model. These predictions give a general decrease of Sα of two orders of magnitude between ^{12}C and ^{40}Ca. It is hoped that theoretical calculations from current wave functions will soon provide a systematic and reliable set of Sα-values for these nuclei, so that it will be possible to examine whether residual interactions lead to more α-cluster probability than the shell model would predict. (FR)

7697 STUDY OF NUCLEI WITH ELECTRON SCATTERING. Torizuka, Y.; Saito, T.; Itoh, K.; Mitsunobu, S.; Sasao, M. (Tohoku Univ., Sendai (Japan). Lab. of Nuclear Science). Kakuriken Kenkyu Hokoku; 7: No. 1, 1-22(Jun 1974). (In Japanese).

Study on the giant resonance of light nuclei is described. Data on the giant resonance of ^{16}O were analyzed by dividing form factor into longitudinal and transverse components. Incident electron energy and scattering angle were set so as to obtain 0.55, 0.85 and 1.05 of q_{eff} (momentum transfer). Strong E1 resonance was observed. The longitudinal component was compared with the total absorption cross section of photons in order to investigate E2 giant resonance. By using Tassie model, E2-like behavior was observed. E2 strength was about 21% of EWSR in the same energy range as the E1 giant resonance. The giant resonance of ^{20}Ne was studied at the electron energy of 183 and 250 MeV. Peaks seen at the excitation energy around 12–16 MeV in observed spectra may be due to E2 transition, and peaks at 17.6, 18.8 and 20.1 MeV may be those of E1 character. Reduced transition probability B (EL) for each peak was obtained and tabulated. Electron scattering experiment of ^{42}Ca was made at the electron energy of 150, 183 and 250 MeV. The form factors and reduced matrix elements B (EL) of first, second and third 3^- states were obtained. The q-dependence of the form factor of the third 3^- state was a little different from the others. Form factors of 1.52 and 6.2 MeV states were also obtained. The form factors of giant resonance state were obtained. The existence of multipole excitation other than E1 was suggested. Analysis was made for E1, E2 and E3 resonances. (JA)

7698 NUCLEUS–NUCLEUS POTENTIAL IN THE TWO-CENTER SHELL MODEL. Tazawa, T. (Tokyo Univ. (Japan). Coll. of General Education). Progr. Theor. Phys. (Kyoto); 51: No. 6, 1764-1782(Jun 1974).

The ^{16}O–^{16}O potential which describes elastic scattering is calculated from the microscopic point of view in the two-center shell model without spin-orbit coupling developed by the Greiner group. The use of variational method can determine the dependence of the oscillator frequency ω(R) on the separation distance and also correct the inadequate asymptotic behavior in Greiner's approach. We discuss the possibility of the formation of nuclear molecule during the collision on the basis of the estimation of the time for nucleon exchange, and also the changeability of the configuration describing the ^{16}O + ^{16}O system by use of the time-dependent perturbation method. This discussion suggests that the collision process is neither adiabatic nor sudden, but intermediate. It is shown that very shallow potential similar to the one obtained by optical model analysis of experimental data can be obtained under the conditions that the two-body force reproduces the saturation properties and that the wave function is totally antisymmetrized. The distortion effects such as the dependence of the frequency ω(R) on the separation distance and the tunnelling of surface nucleons are discussed. (auth)

7699 HALF-LIVES OF SOME RADIONUCLIDES. Lagoutine, F.; Legrand, J.; Bac, C. (CEN de Saclay, Gif-sur-Yvette, France). Int. J. Appl. Radiat. Isotop.; 26: No. 3, 131-135(Mar 1975).

The half lives of eight radionuclides were determined; the following results are obtained: ^{7}Be: 53.17 ± 0.07 days, ^{51}Cr: 27.72 ± 0.08 days, ^{58}Co: 70.78 ± 0.13 days, ^{65}Zn: 243.75 ± 0.35 days, ^{75}Se: 118.45 ± 0.25 days, ^{85}Y: 106.6 ± 0.4 days, ^{131}Cs: 9.66 ± 0.06 days, ^{169}Yb: 31.97 ± 0.05 days. These results are compared with the most recent and accurate values of the literature. (auth)

7700 TOTAL CROSS SECTION FOR THE PHOTONUCLEAR REACTION IN ^{16}O. Gimm, H. Mainz; Univ. Mainz (1971). 69p. (In German). INIS.

Thesis.

The γ-absorption cross section for the nucleus ^{16}O was investigated in the energy range of 10-150 MeV. The measurements took place in the bremsstrahlung of the Mainz linear accelerator by using two magnetic Compton spectrometers on a water absorber. The measured nuclear absorption cross sections show four lines below 20 MeV which correspond to the low-lying 1-(T = 1) states of oxygen (^{16}O). The giant resonance is multiply split up; this agrees with other experiments. Above the giant resonance, the absorption cross section falls slowly. (GE)

7701 EXCITED STATES OF ^{8}Be IN THE REACTION ^{9}Be(d,tα)^{4}He. Dodd, L. R.; Sonnemans, M. A. A.; van Dantzig, R. (Inst. of Nuclear Physics Research, Amsterdam). Lett. Nuovo Cim.; 12: No. 15, 597-600(12 Apr 1975).

Values for the resonance parameters of the first two excited states of ^{8}Be are deduced from the three body reaction ^{9}Be(d,tα)^{4}He at E = 26.3 MeV. It is shown that a simple model, ignoring any dependence on the production process but including the proper threshold dependence of the ^{8}Be resonances, gives excellent agreement between the observed spectra and α-α elastic scattering. The analysis is based directly on the experimental α-α elastic phase shifts. (1 figure) (SDF)

7702 (d,^{6}Li) REACTION ON THE ^{16}O NUCLEI. Goryunov, O. Yu.; Dobrikov, V. N.; Nemets, O. F.; Reuk, E. P.; Rudchik, A. T. (Inst. of Nuclear Research, Moscow). Yadern. Fiz.; 21: No. 1, 3-8(Jan 1975). (In Russian).

Differential cross sections of the reaction ^{16}O(d, ^{6}Li)$^{12}C_{ground}$ measured at E_d = 12.7 MeV are presented, as well as results of analysis of the cross section at E_d = 12.7 and 13.6 MeV based on the theory of α-particle pick-up in framework of the distorted-wave approach. (2 figures, 2 tables) (auth)

7703 INELASTIC SCATTERING OF HIGH ENERGY PROTONS ON THE NUCLEUS ^{16}O. Manaenkov, S. I. (Moscow State Univ.). Yadern. Fiz.; 21: No. 1, 101-112(Jan 1975). (In Russian).

Using the formfactors obtained directly from the data on the electron inelastic scattering on the nucleus ^{16}O, the differential cross sections are calculated for excitation of the levels 6.05 (0^+), 6.13 (3^-), 6.92 (2^+), and 7.12 MeV (1^-) induced by protons with the energy E_{lab} = 1 GeV. Results of the calculations are compared with the experimental data. By means of a simple nuclear model the problem is considered of accuracy of the approximation of single inelastic collision as compared with the Glauber theory. Density matrices for the 2^+ and 3^- levels and the angular distribution of the γ quanta emitted by the nucleus at transitions from these states to the ground state are calculated. General peculiarities are discussed in behavior of the density matrix elements as functions of the momentum transfered to the nucleus. (8 fig.) (auth)

7704 SHELL MODEL STUDY OF THE STRUCTURE OF THE SPHERICAL NUCLEI ^{16}O, ^{42}Ca, ^{92}Zr, and ^{208}Pb AND APPLICA-

TION TO TWO-NUCLEON TRANSFER REACTIONS. Wright, D. P. Austin, TX; Univ. of Texas (1974). 133p. University Microfilms Order No. 75-4484.

Thesis (Ph. D.).

Experiments involving the pickup of two neutrons, via the (p,t) reaction, from zirconium isotopes were performed. Angular distributions of the tritons were measured and the data were analyzed by means of the Distorted Wave Born Approximation. The DWBA calculations involve the wave functions of the transferred pair of nucleons and those wave functions should be obtained from shell calculations. A computer code to perform two-particle shell model calculations was developed and the resulting wave functions used in the DWBA analysis. Some relative spectroscopic factors were thus obtained. The code used a phenomenological velocity dependent potential as a residual interaction. Other calculations with the code were performed for oxygen, calcium and lead. A second code was developed to perform multi-particle shell model calculations and some results obtained for Oxygen are presented. (Diss. Abstr. Int., B)

7705 DEPENDENCE OF THE BINDING ENERGY AND THE PROPERTIES OF COLLECTIVE STATES IN ^{16}O AND ^{40}Ca ON THE OFF-SHELL SCATTERING MATRIX. Singh, Y. (Roorkee Univ., India); Warke, C. S. pp 83-86 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Vol. 16B. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

7706 THREE BODY UPA CALCULATIONS WITH HAMADA-JOHNSTON AND YALE POTENTIALS. Mathur, V. S.; Lagu, A. V.; Maheshwari, C. (Banaras Hindu Univ., Banaras, India). pp 101-103 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

7707 TEST OF A RELATION BETWEEN DEUTERON STRIPPING TO UNBOUND LEVELS AND ELASTIC SCATTERING MEASUREMENTS. Huby, R.; Kelvin, D. (Univ. of Liverpool). J. Phys. G: Nucl. Phys.; 1: No. 2, 203-212(21 Feb 1975).

The work concerns a simple "model-independent" approximation to the energy-differential cross section $d^2\sigma/dEd\Omega$ for a stripping reaction A(d,p)B* into the continuum. For specified angular momentum of B*, this is given by a single-particle cross section calculable with DWBA, multiplied by $\sin^2\delta$, where δ is the phase shift for n-A scattering at a corresponding energy. Though previously applied only to isolated resonances in B*, and for the cross section integrated over energy, the approximation is here tested in detail and as to absolute magnitude across two broad, overlapping resonances of the same spin and parity. Experimental phase shifts for n-^{12}C scattering are used to calculate the spectra of protons at various angles in the $^{12}C(d,p)^{13}C^*$ reaction. The principal resonances in ^{13}C are two $d_{3/2}$ ones, levels 7 and 8. Agreement between calculated and observed spectra is quite good. The spectroscopic factors of the levels are discussed. (auth)

Nuclear Properties and Reactions, 20 ≤ A ≤ 38

Refer also to abstracts 6511, 7696, 7697, 7726, 7733, 7752, 7830, 7855, 7856, 7859, 7860, and 7891.

7708 (BNL-19956) LOW ENERGY TOTAL CROSS SECTION OF ^{36}Ar. Mughabghab, S. F.; Magurno, B. A. (Brookhaven National Lab., Upton, N. Y. (USA)). 3 Mar. 1975. 3p. (CONF-750303-61). Dep. NTIS $4.00.

From proceedings on nuclear cross section and technique; Washington, District of Columbia, USA (3 Mar 1975).

To compare the predictions of the valence model with measured partial radiative widths of ^{36}Ar an accurate knowledge of the bound-level parameters is required. This is achieved by carrying out a Breit-Wigner parameter fit to the total cross section of ^{36}Ar measured by Chrien et al and renormalized to the recommended values of the thermal capture and scattering cross sections. (1 figure, 1 table) (auth)

7709 (BNL-19957) EVIDENCE FOR VALENCE NEUTRON CAPTURE IN S-WAVE NEUTRON CAPTURE IN ^{36}Ar AND ^{54}Fe. Mughabghab, S. F. (Brookhaven National Lab., Upton, N. Y. (USA)). 3 Mar 1975. 5p. (CONF-750303-62). Dep. NTIS $4.00.

From proceedings on nuclear cross section and technique; Washington, District of Columbia, USA (3 Mar 1975).

The valence and channel neutron model of Lane and Lynn remarkably account for partial radiative widths of neutron resonances in the 3p-giant resonance. Evidence is presented for valence neutron capture at and in the neighborhood of the 3s-giant resonance in target nuclei ^{36}Ar and ^{54}Fe. In addition, the variation of the correlation coefficient rho with the reduction power factor n of the gamma ray energy is studied. (4 figures, 1 table) (auth)

7710 (CEN-TS-74-2) CROSS SECTIONS ABSOLUTE MEASUREMENTS IN (p,γ) REACTIONS ON SULFUR AND SILICON ISOTOPES. Boursiquot, C. (Bordeaux-1 Univ., 33 - Gradignan (France). Centre d'Etudes Nucleaires; Bordeaux-1 Univ., 33 (France)). 1974. 45p. (In French). INIS.

Some absolute (p,γ) resonance strength measurements were performed with a Ge(Li) detector in chlorine and phosphorus isotopes and in ^{28}Si. Several compounds of natural sulfur (CdS, ZnS, Ag_2S) as well as natural silicon (Si, SiO, SiO_2) were used. If the sulfur targets yielded very coherent results, whichever compound was used the natural Si was the only reliable silicon compound target. The following resonance strengths were measured: $^{27}Al(p,\gamma)^{28}Si$ E(p) = 633, 744 keV; $^{32}S(p,\gamma)^{33}Cl$ E(p) = 580, 588 keV; $^{34}S(p,\gamma)^{35}Cl$ E(p) = 1214 keV; $^{30}Si(p,\gamma)^{31}P$ E(p) = 620, 2187 keV; $^{28}Si(p,\gamma)^{29}P$ E(p) = 724, 1380, 2285 keV. Special attention was paid to resonance strengths generally used as standards and a comparison of the results with previous absolute measurements lead to a set of (p,γ) strengths (S = (2J + 1) GAMMA(p) + GAMMA(γ)/GAMMA) proposed as standard among which: ^{28}Si E(p) = 633 keV S = 3.4 ± 0.3 eV; ^{31}P E(p) = 620 keV S = 3.4 ± 0.3 eV; ^{33}Cl E(p) = 588 keV S = 0.22 ± 0.03 eV and ^{35}Cl E(p) = 1214 keV S = 9.7 ± 0.9 eV. Consequences of these new values were investigated for the T = ½ analog resonance in ^{31}P, ^{35}Cl and ^{37}Cl. (FR)

7711 (CRN-CNPA-74-26) ENERGY LOSS OF HEAVY IONS IN NUCLEAR COLLISIONS IN SILICON. Grob, J. J.; Grob, A.; Pape, A.; Siffert, P. (Centre National de la Recherche Scientifique, 67 - Strasbourg (France). Centre de Recherches Nucleaires; Strasbourg-1 Univ., 67 (France)). 1974. 26p. INIS.

French translation: CRN-CNPA-74-27.

Heavy ion channeling measurements performed in aligned surface barrier detectors have allowed the determination of energy losses and straggling in nuclear collisions. Results are presented for $^{28}Si^+$ and $^{14}N^+$ in the 300-2000 keV region to illustrate the possibilities of this method. Comparisons of the theoretical and experimental data are made. A dependence of the energy partition between electronic and nuclear collisions on the atomic density along the ion path is demonstrated. (FR)

7712 PHOTODISINTEGRATION OF LIGHT AND MEDIUM-WEIGHT NUCLEI AT INTERMEDIATE ENERGIES. I. Photoproduction of ^{18}F, ^{22}Na, and ^{24}Na from Targets with Masses Up to 40. Di Napoli, V.; Rosa, G.; Salvetti, F.; Terranova, M. L.; de Carvolho, H. G.; Martins, J. B.; Tavares, O. A. P. (Rome Univ.). J. Inorg. Nucl. Chem.; 37: No. 5, 1101-1105(May 1975).

Mean cross sections for the photoproduction of ^{18}F, ^{22}Na and ^{24}Na have been determined from ^{23}Na, ^{27}Al, ^{28}Si, ^{31}P, ^{32}S, $^{35,37}Cl$, ^{39}K, and ^{40}Ca targets using bremsstrahlung beams in the energy range 0.3 to 1 GeV. The results have been compared with a modified Rudstam's CDMD formula and found to be consistent with the cross section dependence predicted on the basis of conventional spallation processes for ^{24}Na only. For ^{18}F and ^{22}Na, some deviations have been observed from the spallation patterns when target mass numbers exceed 31 and 37, respectively, thus suggesting other mechanisms different from spallation being effective in their production, such as fission and fragmentation. (auth)

7713 THE TOTAL CROSS-SECTION FOR THE PHOTONUCLEAR EFFECT IN ALUMINIUM AND SILICON. Gundrum, H. S. Mainz; Univ. Mainz (1972). 35p. (In German). INIS.

Thesis.

According to the "standard nuclei" ^{12}C and ^{16}O, γ-absorption measurements were carried out beyond the region of the giant resonance to the meson barrier also with heavier nuclei. For this, silicon proved to be suitable due to a similar configuration to ^{12}C (completed subshell). The neighboring nucleus ^{27}Al, which has one proton less than Si, was also measured in order to compare with the "half magic" nuclei ^{28}Si. The integrated nuclear absorption cross section is clearly above the value of the classical dipole sum. (GE)

7714 COHERENT BREMSSTRAHLUNG PRODUCED BY RELATIVISTIC POSITRONS AND ELECTRONS ON A SINGLE CRYSTAL OF SILICON. Walker, R. L.; Berman, B. L.; Bloom, S. D. (Univ. of California, Livermore). Phys. Rev., A.; 11: No. 3, 736-742(Mar 1975).

The spectral dependence of the forward coherent bremsstrahlung produced by beams of 28-MeV positrons and electrons incident upon a 5-mu m thick single crystal of silicon was mea-

sured with a NaI photon spectrometer. Effects of channeling and perhaps of the nonvalidity of the first Born approximation were observed for beam directions near the (111) axis of the crystal. A coherent peak near 0.5 MeV for both electrons and positrons was observed for a compound-interference direction, in agreement with first-order theoretical calculations. (auth)

7715 ELASTIC SCATTERING OF ALPHA PARTICLES BY ^{26}Mg. Kanetkar, L. J.; Gupta, S. K.; Kailas, S.; Kerekatte, S. S.; Mehta, M. K. (Bhabha Atomic Research Centre, Trombay, India). pp 27-30 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Vol. 16B. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

7716 GENERATOR-COORDINATE CALCULATIONS FOR THE ELECTRIC QUADRUPOLE MOMENTS AND TRANSITION RATES. Khadkikar, S. B.; Kulkarni, D. R. (Physical Research Lab., Ahmedabad, India). pp 113 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

7717 BAND-MIXING CALCULATIONS FOR Na ISOTOPES. Kulkarni, D. R.; Pandya, S. P. (Physical Research Lab., Ahmedabad, India). pp 153-156 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

7718 GENERATOR COORDINATE SPECTRA OF THE NUCLEI ^{24}Mg, ^{32}S, AND ^{36}Ar. Khadkikar, S. B.; Kulkarni, D. R. (Physical Research Lab., Ahmedabad, India). pp 157-160 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

7719 PHASE TRANSITION AND ANGULAR MOMENTUM DEPENDENCE OF CORRELATIONS IN THE ROTATIONAL SPECTRA OF ^{20}Ne AND ^{22}Ne. Satpathy, L. (Berhampur Univ., Orissa, India); Schmid, K. W.; Krewald, S.; Faessler, A. pp 165-168 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

7720 BAND MIXED SPECTRA OF Na ISOTOPES. Parikh, J. K. (Atomic Minerals Div., New Delhi, India). pp 169-170 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

7721 SHELL-MODEL CALCULATIONS IN THE SD SHELL. III. The Structure of Mass 25 Nuclei. Cole, B. J.; Watt, A.; Whitehead, R. R. (Univ. of Glasgow). J. Phys. G, Nucl. Phys.; 1: No. 1, 17-34(10 Jan 1975).

Shell-model calculations have been performed for ^{25}Na, ^{25}Al and ^{25}Mg including all possible sd shell configurations. The two-body interactions of Kuo and Preedom and Wildenthal were employed. The latter gives good agreement with experimental spectra and electromagnetic transition rates in all cases, but the Kuo interaction produces shifts of whole rotational bands in ^{25}Mg and ^{25}Al. Agreement with data within bands, however, is reasonable. The structure of the three nuclei is discussed in the light of these calculations. (auth)

7722 GROUND STATE BAND OF ^{25}Mg STUDIED BY ELECTRON SCATTERING. Lees, E. W.; Curran, C. S.; Brain, S. W.; Gillespie, W. A.; Johnston, A.; Singhal, R. P. (Univ. of Glasgow). J. Phys. G: Nucl. Phys.; 1: No. 2, L13-L17(21 Feb 1975).

The members of the ground state band of ^{25}Mg have been studied in the momentum transfer range 0.2 to 1.15 fm^{-1}. The reduced transition probabilities and transition radii were measured for the 1.612 MeV and 3.405 MeV levels. The transition probabilities are shown to be considerably more precise than existing measurements and are compared with various theoretical predictions. The hexadecupole strength of the $11/2^+$ levels is also discussed. (auth)

7723 PROPERTIES OF ^{37}Ar. II. Levels Above 3.8 MeV Excitation Energy. Nolan, P. J. (Univ. of Liverpool); Gadeken, L. L.; Brown, A. J. J. Phys. G. Nucl. Phys.; 1: No. 1, 35-52 (10 Jan 1975).

Excitation energies, mean lifetimes, γ ray branching ratios, angular distributions and linear polarizations have been measured for levels in ^{37}Ar above 3.8 MeV excitation energy. The states were populated using the ^{34}S(α, nγ)^{37}Ar reaction at beam energies between 10.5 MeV and 16.0 MeV. Gamma-gamma coincidence measurements at beam energies of 11.5 MeV and 16.0 MeV were used to determine the decay scheme. The results of an intermediate coupling vibrational model calculation for the negative parity states are presented. The 5793 keV($13/2^-$) state is a candidate for a state arising from a two-phonon vibration of the core coupled to a particle in the $f_{7/2}$ orbital. The properties of the high-spin positive-parity states at 5213 keV ($11/2^+$), 6150 keV ($13/2^+$), 6473 keV ($13/2^+$) and 7071 keV ($13/2^+, 17/2^+$) are consistent with the states being the members of the $[(f_{7/2})^3 = 7 \times d_{3/2}^{-1}]$ configuration. (auth)

7724 SHELL-MODEL CALCULATIONS IN THE SD SHELL. IV. Energy Spectra for A = 26 to 31 Nuclei. Cole, B. J.; Watt, A.; Whitehead, R. R. (Univ. of Glasgow). J. Phys. G: Nucl. Phys.; 1: No. 2, 213-229(21 Feb 1975).

Shell-model calculations of the energy spectra for most nuclei with $26 < A < 31$ have been performed. The even parity spectra obtained by use of the Kuo and Preedom–Wildenthal interactions in the full sd-basis are compared with the available experimental information. The shell-model energy survey of the sd-shell to mass 33 with these two interactions is now almost complete. (auth)

Nuclear Properties and Reactions, 39 ≤ A ≤ 58

Refer also to abstracts 7696, 7699, 7704, 7705, 7709, 7712, 7756, 7768, and 7851.

7725 (BNL-19790) RADIATIVE CAPTURE OF NEUTRONS IN THE KEV REGION. Greenwood, R. C.; Chrien, R. E.; Rimawi, K. (Brookhaven National Lab., Upton, N. Y. (USA)). 1975. 4p. (CONF-750303-56). Dep. NTIS $4.00.

From proceedings on nuclear cross section and technique; Washington, District of Columbia, USA (3 Mar 1975).

Essentially monoenergetic neutrons with keV energies can be obtained from a reactor by using suitable filters. To date, prompt gamma-ray spectra have been measured using 24-, 2-, and 1-keV neutrons, obtained through Fe + Al + S, Sc + Ti and ^{6}Li filters, respectively. Two features of these data are of note to reactor shielding. First, the radiative capture spectra from higher Z nuclei usually result from an average over many resonance states. Hence statistical fluctuations in the primary gamma-ray intensities, to which the corresponding thermal neutron capture spectra are subject, are averaged out. Second, such data provide information on the dependence of radiative capture spectra on neutron energy. The data shows that at 24 keV there is a significant p-wave contribution to these spectra, even for those mass regions where the ratio of the p-to-s wave strength function is close to a minima. This occurs because the smallness of the relative penetrability at 24 keV, 0.04 less than $(kR)^2$ less than 0.08 for 100 less than A less than 240, is compensated for by the branching ratio GAMMA/sub gamma// GAMMA which is now much larger for p-wave than for s-wave resonances. (6 figures, 1 table) (auth)

7726 (BNL–19959) PARAMETRIC FIT OF THE TOTAL CROSS SECTION OF ^{45}Sc. Magurno, B. A.; Mughabghab, S. F. (Brookhaven National Lab., Upton, N. Y. (USA)). 3 Mar 1975. 8p. (CONF-750303–60). Dep. NTIS $4.00.

From proceedings on nuclear cross section and technique; Washington, District of Columbia, USA (3 Mar 1975).

A parametric fit to the total cross section of ^{45}Sc based on the Breit-Wigner multilevel formalism was carried out. To reproduce the minimum in the total cross section at 2.0 keV and to get an acceptable fit for the low energy resonances, the spins of the bound level, the 3.24, and 4.27 keV resonances are 4, 3, 4, respectively. At higher energies the spins adopted for the resonances at 6.5, 7.9, 8.9, and 11.7 keV were 3, 4, 3, 4. The parameters of the bound level are E_0 equals –270 eV, GAMMA^0/ sub n/ equals 2.05 eV (J equals 4) and GAMMA/sub gamma / equals 0.38 eV. (2 figures, 2 tables) (auth)

7727 (BNL-tr-601) COLLECTIVE QUANTUM HAMILTONIAN AND THE VARIABLE-MOMENT-OF-INERTIA MODEL. Khodel, V. A. Translated by S. J. Amoretty from Zh. Eksp. Teor. Fiz., Pis'ma Red.; 20: No. 6, 419-423(1974). 9p. Dep. NTIS $4.00.

A procedure is proposed for determining the parameters of the collective Hamiltonian. The methods developed are used in analyzing the variable-moment-of-inertia (VMI) model, which describes fairly accurately the properties of the main excitation band of atomic nuclei in the transition region. (auth)

7728 (COO-3244-37) CHARGED PARTICLE EMISSION FOLLOWING BOMBARDMENT OF NICKEL WITH 220 MeV π^+. Amann, J. F.; Barnes, P. D.; Doss, M.; Dytman, S. A. (Carnegie-Mellon Univ., Pittsburgh, Pa. (USA)). 1975. 2p. (CONF-750447-2). Dep. NTIS $4.00.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

Results are reported from a direct measurement of the production cross sections at 90° for p, t, d, and ^{3}He emission induced by the 220-MeV positive pion beam on magnesium, nickel, and silver. (JFP)

7729 (CRN-PN-74-14) COLLECTIVE AND SINGLE PARTICLE PROPERTIES OBSERVED IN TWO NUCLEI OF THE SUP(1f) $^7/_2$ ORBIT; ^{47}Sr AND ^{47}V. Toulemonde, M. (Centre National de la Recherche Scientifique, 67 - Strasbourg (France). Centre de Recherches Nucleaires; Strasbourg-1 Univ., 67 (France)). 1974. 135p. (In French). INIS.

The ^{47}Sc nucleus was populated by the ^{44}Ca(α,pγ) reaction and the ^{47}V nucleus by the ^{47}Ti(p,nγ) and ^{31}P(^{19}F,p2nγ) reactions. Using the γ spectroscopy some electromagnetic matrix elements are determined; they provide a good test of a particular nuclear model. Different experimental measurements were done: p-γ angular correlations and γ distributions for spin, branching ratio and mixing ratio determinations; lifetime measurements were done using the Doppler shift attenuation method and the "plunger" method. From these measurements, the collective character of the positive parity states was put forward. An explanation of some negative parity states of the ^{47}Sc nucleus have been done using the intermediate coupling model. For the ^{47}V nucleus, a shell model calculation predicts the $^7/_2$-ground state. The agreement between experimental and theoretical electromagnetic properties, supports the validity of the last model. (FR)

7730 (CRN/PN-74-30) LIFETIME MEASUREMENTS OF THE FIRST ^{41}K EXCITED LEVELS. Courdier, L. (Centre National de la Recherche Scientifique, 67 - Strasbourg (France). Centre de Recherches Nucleaires; Strasbourg-1 Univ., 67 (France)). 1974. 39p. (In French). INIS.

The measurement of gamma-ray transitions in ^{41}K via proton-gamma ray coincidence studies in the ^{39}K(t,pγ)^{41}K reaction was performed. Measurements were carried out with the proton detector centered at 180 deg and the gamma ray detector at five angles between 0° and 105 deg to the beam. Excitation energies and decay modes were determined for 19 levels of ^{41}K lying below 3.3 MeV excitation. The mean lives of the first six states were deduced from the Doppler-shift attenuations observed in the transitions. Limitations on possible spin assignments for these states could be placed. The results indicate that the predictions from a model considering configurations of either 2p-3h or 3p-4h with respect to ^{40}Ca cannot very satisfyingly reproduce the experimental data. (FR)

7731 (EURFNR-1241) keV NEUTRON RADIATION CAPTURE AND TOTAL CROSS SECTION OF ^{50,52,53}Cr, ^{54,57}Fe, and ^{62,64}Ni. Beer, H.; Spencer, R. R. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Angewandte Kernphysik). Oct 1974. 57p. (KFK-2063). Dep. NTIS (US Sales Only) $5.45.

Work performed under United States–Euratom Fast Reactor Exchange Program.

Enriched samples of ^{50,52,53}Cr, ^{54,57}Fe and ^{62,64}Ni were measured in capture and with the exception of ^{53}Cr and ^{57}Fe in transmission in the energy ranges 5-200 keV and 10-300 keV, respectively. The capture and total cross section data analyzed provided resonance parameters for both s- and l > 0 wave resonances. s- and p-wave strength functions were determined and neutron width and level spacing distributions established. A positive correlation was found between the radiation widths and the reduced neutron widths. (19 figures, 18 tables) (auth)

7732 (IPNO-TS-74-3) EXPERIMENTAL TECHNIQUE OF MASS AND CHARGE IDENTIFICATION FOR THE HEAVY ION (Ar OR Ca) INDUCED TRANSFER REACTION STUDY. Pouthas, J. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire; Paris-11 Univ., 91 - Orsay (France)). 1974. 137p. (In French). INIS.

The mass and charge of all products with Z ≤ 20 in the reactions: ^{40}Ar (or ^{40}Ca) + ^{58}Ni (or ^{64}Ni) at 280 MeV have been identified. Charges and kinetic energies of the reaction products were obtained with a ΔE-E system consisting of a gas proportional counter (1750 μg/cm^2) for the ΔE measurement associated with a 500 μm surface barrier E detector. The atomic mass was determined by means of a time-of-flight measurement of the nuclei between a thin (70 μg/cm^2) plastic scintillator and the E detector. The use of a voltage preamplifier and a constant fraction discriminator for the E detector gave a very good time resolution. In order to determine if the process studied was a binary one, coincidences have been studied between the light reaction products and the heavy ones. (FR)

7733 STUDY OF SPALLATION REACTIONS ON ARGON USING 600 MeV PROTONS AND NEUTRONS. Fischer, U. D. Freiburg i. B.; Univ. Freiburg i. B. (1973). 54p. (In German). INIS.

Thesis.

The production cross sections of the ^{35}S, ^{33}P, ^{32}P, ^{28}Mg, ^{24}Na, ^{22}Na and ^{7}Be isotopes on argon and chlorine targets are determined using 600 MeV protons. The fast neutron production cross sections of ^{33}P, ^{32}P and ^{35}S, ^{32}P are measured relatively and compared with the proton results. The experimental results are used to determine the production ratio of the two phosphorus isotopes. (GE)

7734 ISOMERIC CROSS-SECTION RATIOS FOR (n,2n) REACTIONS AT 14.8 MeV. Eapen, P. K.; Salaita, G. N. (Southern Methodist Univ., Dallas). J. Inorg. Nucl. Chem.; 37: No. 5, 1121-1124 (May 1975).

Isomeric cross-section ratios for (n,2n) reactions at 14.8 MeV have been measured for the isomeric pairs ^{44m,g}Sc, ^{85m,g}Sr, ^{88m,g}Y, ^{88m,g}Zr, ^{135m,g}Ce and ^{202m,g}Tl. Using the Huizenga-Vandenbosch method, theoretically calculated isomeric ratios have been compared with the measured values to find the probable value of the spin distribution parameter σ. (auth)

7735 ELASTIC AND INELASTIC ELECTRON SCATTERING FROM ^{40}Ar. Wendling, R. D. Mainz; Mainz Univ. (1972). 98p. (In German). INIS.

Thesis.

A low-temperature target for liquid Ar was set up for the electron scattering apparatus of the Mainz 300 MeV linear accelerator. By means of this target, the ground state and the first excited state (1.46 MeV, 2+) of ^{40}Ar was investigated by the electron scattering method. The effective cross sections for the elastic and inelastic scattering in a region of elastic momentum transfer of $0.8 <= q <= 1.8$ fm^{-1} were thus measured at a scattering energy of 247.8 MeV. The ground state charge distribution of ^{40}Ar was determined from the cross sections for the elastic scattering by fitting calculations according to the partial wave method. (GE)

7736 LEVEL STRUCTURE OF ^{55}Mn FROM COULOMB-EXCITED DE-EXCITATION GAMMA-DECAY. Kulkarni, R. G. (Marathwada Univ., Aurangabad, India); Nainan, T. D. pp 40-41 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Vol. 16B. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

7737 LEVELS IN ^{48}V VIA THE (d,α) REACTION. Kulkarni, R. G. (Marathwada Univ., Aurangabad, India); Lee, S. T.; Long, D. D. pp 79-82 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Vol. 16B. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

7738 COMPARATIVE STUDY OF VARIOUS THEORIES OF ROTATIONAL LEVELS FOR SELECTED LIGHT NUCLEI. Krishna Rao, N.; Satyanarayana, U.; Ramamurty, S. (Andhra Univ., Waltair, India). pp 142 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

7739 SHELL MODEL CALCULATION FOR ODD Tl ISOTOPES. Kulkarni, D. R.; Dhar, A. K.; Bhatt, K. H. (Physical Research Lab., Ahmedabad, India). pp 146-148 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

7740 DOUBLE HUMPED BARRIERS IN MEDIUM WEIGHT NUCLEI. Bhatt, K. H.; Dhar, A. K.; Kulkarni, D. R. (Physical Research Lab., Ahmedabad, India). pp 161-164 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

7741 ELECTROMAGNETIC PROPERTIES OF ^{55}Mn. Patarwale, P. N.; Kanitkar, R. G.; Kulkarni, R. G. (Marathwade Univ., Aurangabad, India). pp 211-213 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

7742 ^{40}Ca(n,α)^{37}Ar CROSS SECTION FROM 3 to 14.7 MeV. Barnes, J. W.; Bayhurst, B. P; Erkkila, B. H.; Gilmore, J. S.; Jarmie, N.; Prestwood, R. J. (Los Angeles County Harbor General Hospital, Torrance, CA). J. Inorg. Nucl. Chem.; 37: No. 2, 399-401(Feb 1975).

The ^{40}Ca(n,α)^{37}Ar reaction cross section has been measured at twelve neutron energies between 3 and 14.7 MeV using radiochemical techniques. The ^{37}Ar, separated from CaO targets, was counted on an external Si(Li) detector. The ^{115}In(n,n')^{115m}In or the ^{27}Al(n,α)^{24}Na reactions were used to determine neutron fluences. The relative error in the Ca cross sections is estimated to be 3 per cent, and the absolute error 6 per cent. (auth)

7743 SPALLATION CROSS SECTIONS IN HIGH ENERGY NUCLEAR REACTIONS WITH MEDIUM MASS TARGETS 21 < = Z < = 29 AND 0.15, 0.3, AND 0.6 GeV PROTONS. Lagarde-Simonoff, M.; Regnier, S.; Sauvageon, H.; Simonoff, G. N.; Brout, F. (Univ., Bordeaux). J. Inorg. Nucl. Chem.; 37: No. 3, 627-630(Mar 1975).

The production cross sections of ^{42}K, ^{43}K, ^{44m}Sc, ^{46}Sc, ^{47}Sc were measured in natural Sc, Ti, V, Fe, Co and Cu irradiated by 0.15, 0.3, 0.6 GeV protons. These experimental values were then compared with calculated cross sections using semi empirical formulas. (auth)

7744 14.8 MeV NEUTRON-INDUCED (n,2n), (n,p), and (n,α) CROSS-SECTIONS FOR SOME CLOSED SHELL NUCLIDES. Sigg, R. A.; Kuroda, P. K. (Univ. of Arkansas, Fayetteville). J. Inorg. Nucl. Chem.; 37: No. 3, 631-636(Mar 1975).

The activation cross-sections for 12 (n,p), (n,α) and (n, 2n) reactions have been determined with 14.8 MeV neutrons using enriched sample materials and Ge(Li) γ-ray detection. The closed shell nuclides studied are ^{54}Fe, ^{90}Zr, ^{92}Mo, ^{141}Pr and ^{144}Sm. The measured (n,2n) cross-section values are compared with those calculated by theoretical and empirical methods, and to plots of σ(n,2n) vs the asymmetry parameter. A plot of the (n,2n) experimental data, which accounts for differences in nuclear radii and threshold energies for the same value of asymmetry parameter, is presented. (auth)

Nuclear Properties and Reactions, 59 ≤ A ≤ 89

Refer also to abstracts 7699, 7727, 7728, 7731, 7732, 7734, 7743, 7761–7763, 7768, and 7806.

7745 (CEA-CONF-2960) NUCLEAR STRUCTURE INVESTIGATION OF ^{72}Ge, ^{70}Ge LOW-LYING 0$^+$ STATES BY ^{71}Ga, ^{69}Ga (d,n)^{72}Ge, ^{70}Ge REACTIONS. Ardouin, D.; Uzureau, J.; Adam, A.; Bersillon, O. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 92 - Montrouge (France)). 1974. 1p. INIS.

From international conference on nuclear structure and spectroscopy; Amsterdam, Netherlands (9 Sep 1974).

The ^{71}Ga, ^{69}Ga(d,n)^{72}Ge, ^{70}Ge reactions were studied at 11 MeV incident energy. L = 1 transitions with cross sections about 0.3 to 0.4 mb/sr were obtained for the two ground state transitions and also for 0$^+_2$ states at 0.690 MeV in ^{72}Ge and at 1.216 MeV in ^{70}Ge when compared with the ground states, these low-lying 0$^+_2$ states are strongly populated. (FR)

7746 SKHEMY RASPADA RADIOAKTIVNYKH YADER A = 70–79. (Decay Schemes of the Radioactive Nuclei A = 70–79). Properties of Atomic Nuclei, Issue 16. Dzhelepova, B. S. Leningrad; Izdatel'stvo Nauka 296p.

This monograph is devoted to the properties of atomic nuclei with mass numbers A = 70 to 79. In the book are assembled and arranged all experimental data characterizing properties of the stable and radioactive isotopes: information on the masses of the nuglei, magnetic and electric moments, lifetimes of nuclear states, the most reliable information on characteristics of radiation, nuclear reactions leading to excited states of nuclei, quantum characteristics of levels, and other properties of the nuclei studied. On the basis of a critical analysis of the entire assemblage of information there are constructed decay schemes for the radioactive nuclei with mass numbers A = 70 to 79, as well as the sequences of excited states of the stable isotopes lying in this nuclear region. (tr-auth)

7747 SEARCH FOR ^{89}Mo. Hagenauer, R. C.; O'Kelley, G. D.; Eichler, E. (Oak Ridge National Lab., TN). J. Inorg. Nucl. Chem.; 37: No. 5, 1111-1114(May 1975).

An attempt was made to produce the ^{89}Mo which had been previously reported as having a half-life of 7.1 min. Use was made of the ^{90}Zr(^{3}He,4n)^{89}Mo, ^{93}Nb(p,5n)^{89}Mo, and ^{92}Mo(p,p3n)^{89}Mo reactions. Molybdenum was chemically separated rapidly from the target, but neither new radiations nor the growth of ^{89}Nb were observed. An upper limit on the half-life of ^{89}Mo assuming a 9/2$^+$ spin was set at 2 min and for the 1/2$^-$ assumption at 1 min. (auth)

7748 SENSITIVITY OF THE (t,p) ANGULAR DISTRIBUTION BELOW THE COULOMB BARRIER OF THE ENTRANCE CHANNEL TO THE RADIAL TWO-NEUTRON FORM FACTOR. Iwasaki, Y. (Shizuoka Univ., Japan); Murata, T.; Tamura, T.; Nogami, Y. Lett. Nuovo Cim.; 12: No. 15, 586-590(12 Apr 1975).

It is argued upon experimental grounds that the (t,p) angular distribution shape tends to be sensitive to the functional form of the form factor over a wide region outside the nucleus at energies below the Coulomb barrier of the entrance channel. Experimental and DWBA results for the L = 0 transition in ^{63}Cu(t,p)^{65}Cu and ^{65}Cu(t,p)^{67}Cu are compared for E = 3.2 MeV. A noticeable difference in angular distribution shape is apparent between the two reactions. (3 figures, 1 table) (auth)

7749 TOTAL-ABSORPTION CROSS-SECTIONS FOR PHOTONS IN Cu, Sn, Pr and Pb. Garimella, S. R. Mainz; Univ. Mainz (1971). 46p. INIS.

Thesis.

The photonuclear cross section in ^{141}Pr in the energy range of 9-35 MeV is determined by the total absorption method. In order to calculate accurate pair production cross sections in Pr, the Coulomb correction (for pair production cross sections) in Cu (from 10-11 MeV and at 50 MeV), Sn and Pb (from 10-100 MeV) is investigated. The results are compared with previous measurements and with predictions of the dynamic collective model. (GE)

7750 ELECTRIC QUADRUPOLE TRANSITIONS IN ^{88}Sr AND ^{90}Zr. Borzov, I. N.; Kamerdzhiev, S. P. Yadern. Fiz.; 21: No. 1, 31-39(Jan 1975). (In Russian).

In framework of the theory of finite Fermi-systems energies of 2$^+$ levels in the interval 0–30 MeV and the probabilities of the E2 transitions from the ground state to the excited level are calculated for nuclei ^{88}Sr and ^{90}Zr. All the levels are of the particle-hole nature and are calculated using the known values of the theoretical constants. A satisfactory agreement with the available experimental data is obtained for three most interesting regions of the spectrum: the first 2$^+$ levels and the centers of gravity for the low-lying and high-lying branches of the E2 resonance. The 2$^+$ level of the low-lying branch with energy approximately 12 MeV has the maximal value of B(E2). (2 tables, 2 figures) (auth)

7751 ANALYSIS OF SPECTRA OF INELASTICALLY SCATTERED NEUTRONS WITH ACCOUNT OF DIRECT INTERACTIONS. Luk'yanov, A. A.; Sal'nikov, O. A.; Saprykin, E. M. Yadern. Fiz.; 21: No. 1, 67-81(Jan 1975). (In Russian).

Spectra of emitted neutrons have been measured for a number of nuclei by means of the time-of-flight technique at two incident neutron energies, 14.36 and 9.1 MeV. The most specific deviations from the evaporation model spectra in the energy and angular behaviors are interpreted as a contribution from the direct interaction. A practical scheme is elaborated to estimate this contribution to the double differential cross section of the inelastic scattering, measured with a wide resolution. As a result, the nuclear temperatures T are determined, the relative contribution from the direct interaction to the integral cross sections of the reaction (n,2n) are found, and a physical interpretation is presented for observed properties in angular distributions of inelastically scattered neutrons in framework of the shell-model approach. (4 figures, 1 table) (auth)

7752 ELASTIC AND INELASTIC SCATTERING OF 12.0-MeV PROTONS FROM ^{84,86}Kr. Arora, B. K. Austin, TX; Univ. of Texas (1974). 131p. University Microfilms Order No. 75-4316.

Thesis (Ph. D.).

Differential cross sections for elastic and inelastic scattering of 12.0-MeV protons from ^{84}Kr and ^{86}Kr have been measured. Spins, parities and deformation parameters for the nuclear states in ^{84}Kr and ^{86}Kr have been extracted by comparing the experimental results with the predictions of both the DWBA and the coupled-channel theories. In both the nuclei, it has been found that most of the scattering strength to the "two phonon" states proceed through their one-phonon components. In addition, angular distribution measure-

ments have been performed for the $^{22}Ne(d,t)^{21}Ne$ reaction at 12.0-MeV incident deuteron energy and the ground state rotational band of ^{21}Ne has been studied with coupled-channel Born-Approximation (CCBA) analysis. (Diss. Abstr. Int., B)

7753 PROPERTIES AND STRUCTURE OF $^{74,76}Br$ FROM THE $^{74,76}Se(p,n)$ REACTION. Lueders, D. H. New Orleans; Tulane Univ. (1974). 101p. University Microfilms Order No. 75-2939. Thesis (Ph. D.).

Targets of selenium metal enriched to 78.61 percent in ^{74}Se and 86.10 percent in ^{76}Se were bombarded with protons from a 15 MeV FN Tandem Van de Graaff accelerator. Proton energies were 5.8-9.0 MeV. Threshold energies for the $^{74}Se(p,n)^{74}Br$ and $^{76}Se(p,n)^{76}Br$ reactions were determined by examining excitation functions obtained with a 3 mm thick (Si(Li)) detector and a 30cc Ge(Li) detector. Verification of the threshold for the $^{74}Se(p,n)$ reaction were made by analysis of the beam-off gamma-ray spectra of the decay of the residual nuclei. Threshold results were used to deduce $^{74,76}Br$ mass excesses and these were compared to theoretical predictions. Subsequent to determination of the reaction thresholds, the gamma-ray spectra, taken in 10-25 keV steps up to 700 keV above threshold, were analyzed through threshold behavior and energy sums to construct a level scheme. Two Ge(Li) detectors were used for gamma-gamma coincidence measurements and the data was analyzed to complete the ^{74}Br and ^{76}Br level schemes. Level schemes were compared to schemes developed through other reactions. (Diss. Abstr. Int., B)

7754 THE BETA-SPECTRUM OF RUBIDIUM 87. Measurement at Low Energies Using a 4π-Proportional Counter and New Evaluation of the Form Factor. Ruettenauer, B. Muenster, Ger.; Muenster Univ. (1970). 50p. (In German). INIS. Thesis.

A low-background 4π-proportional counter was used for new measurements of the β-spectrum of ^{87}Rb. The main feature of interest was the curve at low energies. In addition, the dependence of the spectrum on the thickness of the layer of the sample was determined. The shape of the spectrum can be used to provide information about the different transition matrix elements. (GE)

7755 NATURE OF THE 632 keV ($^5/_2^+$) STATE IN ^{77}As AND THE LIFETIME OF THE 350 keV ($^5/_2^+$) STATE IN ^{143}Pr. Chopra, R. C.; Tandon, P. N.; Devare, S. H.; Devare, H. G. (Tata Inst. of Fundamental Research, Bombay). pp 199-202 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

7756 PHOTOPRODUCTION OF CHARGED PIONS FROM ^{41}K, ^{60}Ni, AND ^{65}Cu. Prasad, G. N. S.; Devanathan, V. (Univ., Madras). pp 53-56 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Vol. 16B. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

7757 ISOBARIC ANALOGUE STATES OF ^{73}Ge VIA ^{73}Ge $(^3He,d)^{73}As$ REACTION. Ramaswamy, C. R. (Bangalore Univ., India); Puttaswamy, N. G.; Sarma, N. pp 75-78 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Vol. 16B. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

7758 ARE THE NUCLEI WITH N APPROX. 43 DEFORMED? Lal, B. (Tata Inst. of Fundamental Research, Bombay); Bharathi, S. M.; Baba, C. V. K. pp 177-180 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

7759 DECAY AND ISOMERISM OF ^{70}Se. LaBrecque, J. J. (Rensselaer Polytechnic Inst., Troy, NY); Preiss, I. L.; Bakhru, H.; Morse, R. I. J. Inorg. Nucl. Chem.; 37: No. 3, 623-626(Mar 1975).

Isomeric states of ^{70}Se were produced via the heavy-ion compound-nuclear process and the positron decay of ^{70}Br. Ge(Li) detectors as well as scintillation detectors show the presence of isomers with half-lives of 20 ± 2 min for the low spin and 4 ± 1 min for the high spin states. The low spin state gives rise to 173, 204, 254, 377 and 428 keV gamma-rays while the high spin state gives rise only to the 173 keV gamma-ray. The high spin state is deduced to be 3 + or 4 +. The $E_{\beta max}$ is 1.7 ± 0.2 MeV. (auth)

Nuclear Properties and Reactions, 90 ≤ A ≤ 149

Refer also to abstracts 6545, 7318, 7513, 7699, 7704, 7727, 7728, 7744, 7749–7751, 7755, 7789, 7806, and 7851.

7760 (BNL–19958) NEUTRON CROSS SECTIONS AND THEIR UNCERTAINTIES OBTAINED FROM NUCLEAR SYSTEMATICS. Pearlstein, S. (Brookhaven National Lab., Upton, N. Y. (USA)). 3 Mar 1975. 8p. (CONF-750303–63). Dep. NTIS $4.00.

From proceedings on nuclear cross section and technique; Washington, District of Columbia, USA (3 Mar 1975).

Previously, neutron cross sections in the MeV range for nuclei ranging in Z from 21 through 41 were calculated using a hybrid empirical-statistical model code THRESH. The formalism includes level density, Coulomb barrier, and competing reaction effects and has been useful in the prediction of unmeasured cross sections or normalized to point measurements to generate complete excitation curves. Reaction data up to 20 MeV in the Z range 21 through 83 are used to refine the model and extend its range of validity. A least squares fitting technique optimizes the choice of parameters with the resulting matrix used to determine parameter uncertainties and correlations. Fitted cross sections and their calculated uncertainties are compared with measurements and quoted errors. A range of uncertainty is assigned to predicted cross sections. (2 figures, 3 tables) (auth)

7761 (IC–74-62) STATIC QUADRUPOLE MOMENTS AND B(E2) (0 → 2) VALUES IN 2p–1f SHELL NUCLEI. Sharma, S. K. (International Centre for Theoretical Physics, Trieste (Italy)). Jul 1974. 7p. INIS.

The quadrupole moments of the first excited states and the reduced transition probabilities for E2 transitions in even-even Ti, Cr, Fe and Ni isotopes are calculated from the projected Hartree-Fock-Bogolubov wave functions in the 2p–1f shell. The overall agreement between the calculated and experimental results is quite good. (auth)

7762 (JINR-E7-8616) QUASIMOLECULAR KX-RAY EXCITATION BY BOMBARDING Zr, Nb, AND Mo TARGETS WITH 96 MeV Nb IONS. Frank, W.; Gippner, P.; Kaun, K. H.; Sodan, H.; Schulze, W.; Tretyakov, Yu. P. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 10p. Dep. NTIS (US Sales Only) $4.00.

By bombarding various targets with 96-MeV Nb ions continuous x-ray distributions have been obtained, which range up to the Kx-ray energies of quasiatoms with $Z = Z_1 + Z_2$. The high energy parts of these continua are interpreted as Kx radiation of quasimolecules transiently formed during the adiabatic heavy ion-atomic collisions. (1 figure, 1 table) (auth)

7763 (LBL–3487) RECENT MULTINUCLEON TRANSFER EXPERIMENTS WITH HEAVY IONS AT BERKELEY. Harvey, B. G. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Apr 1975. Contract W-7405-ENG-48. 13p. (CONF-750447-3). Dep. NTIS $4.00.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

Recent research on multinucleon transfer using heavy ions is discussed with emphasis on two, three, and four nucleon transfer reactions. The presentation centers on the problem of obtaining information about clustering phenomena. (13 figures, 1 table) (SDF)

7764 (NEANDC-99-U) SUMMARY RECORD OF THE SEVENTEENTH MEETING (TECHNICAL SESSIONS), TOKYO, JAPAN, 24–29 MARCH 1974. Conde, H. (comp.). (European American Nuclear Data Committee). 1974. 54p. Dep. NTIS (US Sales Only) $5.75.

New facilities and changes of existing facilities for nuclear data measurements were reported along with plans for building heavy ion accelerators. A large number of nuclear data measurements in progress were discussed in relation to nuclear data request lists. A session was devoted to discussion of needs for nuclear data for fusion reactors, safeguards and biomedical applications. The international cooperation of elastic and inelastic cross section measurements and on computor codes for nuclear model calculations and data analysis was discussed. The current NEA and US activities on data indexing, compiling and evaluation were presented. (SDF)

7765 (ORO-3948-07) PION INTERACTIONS AT MEDIUM ENERGIES. Progress Report, September 1, 1974–August 31, 1975. Allred, J. C.; Mayes, B. W, II; Hungerford, E. V, III. (Houston Univ., Tex. (USA)). 1975. Contract AT(40-1)-3948. 41p. Dep. NTIS $5.25.

Within this past year research was undertaken at the Los Alamos Meson Physics Facility, Space Radiation Effects Laboratory, and Brookhaven National Laboratory. Data were obtained on $\pi^{\pm}$ scattering from ^{12}C, ^{16}O, ^{40}Ca and ^{208}Pb at forward angles, the break-up of deuterium by 600 and 800 MeV protons, and pion production by protons incident on deuterium and hydrogen. Research continued in the development of multistrip scintillation detectors and in multiwire proportional detectors. A data analysis computer should be operational by the end of the contract year. A list of publications is included. (auth)

7766 (UCRL-76629) TABULAR CROSS SECTION FILE GENERATION AND UTILIZATION TECHNIQUES. Cullen, D. E.; Ozer, O.; Weisbin, C. R. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Mar 1975. 5p. (CONF-750303-48). Dep. NTIS $4.00.

From proceedings on nuclear cross section and technique; Washington, District of Columbia, USA (3 Mar 1975).

Criteria of importance to the generation of linear cross section tabulations are presented. Algorithms for reducing or thinning such tables within a desired accuracy criterion and the implementation of paging techniques for efficient utilization of large data tables are reviewed. (1 figure, 3 tables) (auth)

7767 PRECISE MEASUREMENT OF γ INTENSITIES OF ^{141}Ce(145 keV) AND ^{241}Am(59 keV). Legrand, J.; Perolat, J. P.; Bac, C.; Gorry, J. (CEN de Saclay, Gif-sur-Yvette, France). Int. J. Appl. Radiat. Isotop.; 26: No. 4, 179-185(Apr 1975). (In French).

The γ intensities of ^{141}Ce (145 keV) and ^{241}Am (59 keV) have been determined with great accuracy using $4\pi\ \beta-\gamma$ or $4\pi\ \alpha-\gamma$ techniques for activity measurement and a NaI(Tl) well crystal with a Be window for γ emission rate measurement on the same sources. The results give (48.44 ± 0.41)% for ^{141}Ce and (36.3 ± 0.4)% for ^{241}Am. Furthermore for ^{141}Ce from the measurement of $X_K/\gamma = 0.328 \pm 0.006$ $\alpha_K = 0.359 \pm 0.016$, $\alpha_t = 0.421 \pm 0.021$ and the intensity of the β^- transition feeding the 145 keV level, (68.8 ± 1.6)% are deduced. (auth)

7768 NUCLEAR DATA SHEETS: RECENT REFERENCES. Nucl. Data Sheets.; 15: No. 1, 1-106(May 1975).

This publication is a current guide to experimental nuclear physics papers, issued three times per year. The information is described by a keyword string, from which the user should be able to tell whether the indexed papers contain results relevant to his interests. Each issue supplements earlier ones, the present volume covering literature received by the Nuclear Data Project or assigned key numbers between September 1 and December 15, 1974. Recent references contains three major sections: key numbers and key words, reaction index, and references. (RWR)

7769 DECAYS OF THE TWO STATES OF ^{115}Te $1/2^+$ ($T_{1/2}$ = 7.5 MIN) AND $1/2^+$ ($T_{1/2}$ = 6.0 MIN). Charvet, A.; Chery, R.; Do Huu Phuoc; Duffait, R.; Morgue, M. (Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire). J. Phys. (Paris).; 35: No. 11, 805-811(Nov 1974). (In French).

In a study of the decay of ^{115}Te two activities with half-lives of 7.5 ± 0.3 min and 6.0 ± 0.2 min have been observed. By means of Ge(Li) detectors, both single and coincidence γ spectra were measured. Of the 38 transitions, which were identified, 29 can be placed in the level scheme of ^{115}Sb. The data are discussed in the framework of the shell model. The activities are assigned to $1/2^+$ (7.5 min) and $1/2^+$ (6 min) states. There was no evidence for the isomeric transition between these two states. (FR)

7770 ENERGY LEVELS OF ZIRCONIUM ISOTOPES USING MODIFIED SURFACE DELTA INTERACTION. Rao, G. R.; Subudhi, K. S. (Birla Inst. of Tech. and Science, Pilani, India). pp 94-97 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Vol. 16B. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

7771 LEVEL STRUCTURE STUDIES IN ^{140}La AND ^{140}Ce. Singh, N.; Bhati, S. S.; Trehan, P. N. (Panjab Univ., Chandigarh, India). pp 181-184 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

7772 DECAYS OF 40-MIN ^{123m}Sn AND 6.2-MIN ISOMER OF ^{130}Sb. Tikku, V. K.; Singh, H.; Sethi, B. (Saha Inst. of Nuclear Physics, Calcutta). pp 189-191 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

7773 DECAY OF $^{127m+g}Te$ TO LEVELS OF ^{127}I. Soni, S. K.; Kumar, A.; Ghosh, D.; Gupta, S. L.; Pancholi, S. C. (Univ., Delhi). pp 192-194 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

7774 INTERNAL CONVERSION MEASUREMENTS OF TRANSITIONS IN ^{143}Pr. Ramanish, K. V.; Reddy, T. S.; Reddy, K. V. (Andhra Univ., Waltair, India). pp 206 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

7775 SPIN OF THE 1251 keV LEVEL IN ^{97}Nb. Priyadarsini, D. K.; Reddy, B. V.; Sastry, B. R.; Rao, V. S.; Sastry, D. L. (Andhra Univ., Waltair, India). pp 209-210 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P-16B.

7776 INTERNAL BREMSSTRAHLUNG FROM ^{147}Pm. Babu, R. P.; Narasimhamurthy, V. A.; Narasimhamurty, K. (Andhra Univ., Waltair, India). J. Phys., A (London); 7: No. 18, 2295-2303(11 Dec 1974).

The shape of the continuous internal bremsstrahlung accompanying the β decay of the radioactive nuclide ^{147}Pm is experimentally measured with a NaI(Tl) scintillation spectrometer and compared with the Knipp, Uhlenbeck and Block (KUB) theory as well as with the Coulomb-corrected theories due to Lewis and Ford, and Nilsson. The experimental distribution is found to agree fairly well with the KUB theory in the energy region from 60 to 85 keV and beyond 85 keV and beyond 85 keV the experimental distri and beyond 85 keV the experimental distribution is in excess over KUB theory, the excess being 13% at 95 keV, 32% at 130 keV and 80% at 155 keV. However, very good agreement is found between the experimental distribution and the theoretical one due to Lewis and Ford throughout the investigated energy region. (auth)

7777 SEARCH FOR A HIGH-SPIN ISOMER OF ^{112}Ag. Rosner, G.; Weinreich, R.; Herrmann, G. (Univ., Mainz). J. Inorg. Nucl. Chem.; 37: No. 2, 575-577(Feb 1975).

To date in the published reports on ^{112}Ag no isomeric state has been mentioned. A search was made for such an isomer, because decay data of silver nuclides are important for radiochemical investigations on the symmetric nuclear fission. Experimental details are presented. The results, however, do not provide any evidence for such an isomer. (auth)

7778 MEASUREMENTS OF THE NUCLEAR CHARGE DISTRIBUTION IN THE CADMIUM ISOTOPES. Gillespie, W. A. (Univ. of Glasgow); Brain, S. W.; Johnston, A. J. Phys. G, Nucl. Phys.; 1: No. 1, L6-L8(10 Jan 1975).

The RMS radii $\sqrt{\langle r^2 \rangle}$ of the charge distributions of the even isotopes $110 \leq A \leq 116$ of cadmium have been measured by electron scattering, and the differences $\delta\langle r^2 \rangle$ for $106 \leq A \leq 116$ by optical isotope shifts. The methods indicate the same trend in $\delta\langle r^2 \rangle$ but there is quantitative disagreement. (auth)

Nuclear Properties and Reactions, 150 ≤ A ≤ 189

Refer also to abstracts 7725, 7727, 7768, 7857, and 7861.

7779 (IPNO-1972, pp 4) E2/M1 MIXING RATIOS IN ^{192}Pt, ^{190}Pt, ^{188}Pt, AND ^{186}Pt EVEN–EVEN ISOTOPES. Caillieu, M.; Foucher, R.; Husson, J. P. [nd]. (In French).

In 1972 annual report. (Paris-11 Univ., 91 – Orsay (France). Inst. de Physique Nucleaire).

Experimental values for mixing ratios in even–even ^{192}Pt, ^{190}Pt, ^{188}Pt, and ^{186}Pt are given. Results in ^{192}Pt are in agreement with values calculated by Kumar and Baranger. (auth)

7780 (IPNO-1972, pp 8) MULTI-DIMENSIONAL γ-γ COINCIDENCES IN ^{175}Ta. Ader, B.; Ohlsson, H.; Perrin, N. [nd]. (In French).

In 1972 annual report. (Paris-11 Univ., 91 – Orsay (France). Inst. de Physique Nucleaire).

Following the decay of ^{175}W, γ-γ coincidences give the two lowest excited levels and seven higher energy levels of ^{175}Ta. (auth)

7781 (JINR-P3-8458) MEASUREMENT OF THE SPIN-DEPENDENT NEUTRON SCATTERING AMPLITUDES OF ^{159}Tb BY NEUTRON DIFFRACTION IN ANTIFERROMAGNET AT ULTRA LOW TEMPERATURES. Akopyan, G. G.; Alfimenkov, V. P.; Lason, L.; Ovchinnikov, O. N.; Sharapov, E. I. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 16p. (In Russian). Dep. NTIS (U. S. Sales Only) $4.00.

The measurement of the spin-dependent scattering amplitudes in nuclei by unpolarized neutron diffraction in an antiferromagnetic target at ultra low temperatures is described. The difference of the spin amplitudes of ^{159}Tb has been measured in the diffraction experiment at the Pulsed Reactor using the dilution refrigerator. The value is $a_+ - a_- = -0.35 \pm 0.14$ fm. The obtained value for the spin-incoherent cross-section is σ_{inc} (Tb) = 5 ± 4 mb. (3 figures, 1 table) (auth)

7782 (PTUM-E-18) MEASUREMENT OF CONVERSION ELECTRONS AFTER NEUTRON CAPTURE OF ^{160}Tb, ^{151}Sm, ^{116}In, AND ^{156}Gd. Schreckenbach, K. (Technische Univ. Muenchen (F. R. Germany). Fakultaet fuer Allgemeine Wissenschaften). May 1973. 100p. (In German). INIS.

17 tabs.; with refs.

In the first part apparative news of the β-spectrometer of the FRM are described. The second part deals with the conversion electron measurements on Tb-160, Sm-151, In-116 and Gd-156. The reaction Tb-159 (n,e) Tb-160 lead to new multipolarities in 9 transitions below 63 keV. Together with (n,γ)-measurements in Risoe and Fribourg the scarcely known level scheme of the odd-odd nucleus Tb-160 was developed in the low energy region. 7 rotational bands were found and discussed in detail. Experimental branching ratios, splitting and odd-even shift are compared with theoretical predictions. The measurement on Sm-151 was accomplished following the crystal spectrometer measurement at Risoe. It yielded 11 multipolarities up to 200 keV. The conversion electron spectrum of In-116 was measured up to 600 keV and multipolarities to 44 transitions were determined. 6 levels were assigned new spins and parities. One multiplet at about 1 MeV is seen as a single-phonon vibration. The measurement on the even-even nucleus Gd-156 contained the energy region from 80 keV to 10 MeV. About 400 electron lines were measured. The conversion electrons of primary transitions could be established for the first time and multipolarities were determined. Level schemes of Gd-156 are discussed and extended by new spin and parity values. (GE)

7783 MEASUREMENT OF AN ELECTRIC HEXADECAPOLE TRANSITION MATRIX ELEMENT IN ^{152}Sm AND ^{154}Sm. Ebert, W. Erlangen, Ger.; Univ. Erlangen-Nuernberg (1972). 92p. (In German). INIS.

Thesis.

The relative intensities of the γ radiation from the 4^+ to the 2^+ state and from the 2^+ to the 0^+ state were measured in ^{152}Sm and ^{154}Sm after Coulomb-excitation by bombardment with α particles of 12 MeV, ^{16}O ions of 27 MeV and ^{32}S ions of 38 MeV. The hexadecapole transition matrix element $(0^+/M(E4)/4^+)$ could be computed from the difference between the E4 and the total excitation of the 4^+ state. The charge deformation parameters for ^{152}Sm and ^{154}Sm were also computed from the matrix elements for the E4 and E2 transitions. (GE)

7784 THE DECAY OF ^{153}Tb TO LEVELS IN ^{153}Gd. Peghaire, A.; Aguer, P.; Torres, J. P. (Centre National de la Recherche Scientifique, 91 - Orsay (France). Centre de Spectrometrie Nucleaire et de Spectrometrie de Masse). J. Phys. (Paris), Lett.; 35: No. 11, L207-L211(Nov 1974).

The decay of ^{153}Tb to ^{153}Gd has been investigated using isotopically separated samples. Gamma ray and conversion electron energies and intensities were measured using means of Ge(Li and Si(Li) detectors. (FR)

7785 DETERMINATION OF CORE DEFORMATION OF ^{152}Sm WITH THE HELP OF INTERFERENCE EFFECTS BETWEEN CORE- AND COULOMB-INTERACTIONS. Traxel, K. Heidelberg; Heidelberg Univ. (1973). 49p. (In German). INIS.

Thesis.

The question which has recently arisen as to whether charge and mass distribution are different in ^{152}Sm, is considered. The scattered particles after bombarding a thin ^{152}Sm target with α particles between 11 and 18 MeV were detected under 7 angles between 70° and 170° and the cross sections for inelastic scattering with excitation of the 2^+ or 4^+ rotation level were determined. The measured data were analyzed with a program working according to the coupled channel method and assumes a complex optical potential as core part of the interaction. (GE)

7786 COMPARATIVE STUDY OF VARIOUS THEORIES OF ROTATIONAL LEVELS IN THE RARE EARTH REGION. Ramamurty, S.; Satyanarayana, U.; Krishna Rao, N.; Subramanyam, V. V. V. (Andhra Univ., Waltair, India). pp 141 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

7787 SPECTRUM AND STATIC MOMENTS OF ^{186}Re. Garg, V. P.; Sharma, S. D. (Punjabi Univ., Patiala, India). pp 175 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

7788 RELATIVE INTENSITIES OF GAMMA RAYS IN ^{187}Re. Subba Rao, K.; Ila, P.; Sudhakar, K.; Narasimham, K. L.; Lakshminarayana, V. (Andhra Univ., Waltair, India). pp 203 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

7789 REORIENTATION PRECESSION. Somayajulu, D. R. S.; Grodzins, L.; Herskind, B.; Skaali, B.; Genevese, F.; Kalish, R. (Niels Bohr Inst., Copenhagen). pp 246-249 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

7790 DETERMINATION OF FRACTIONAL FISSION YIELDS FROM CHEMICAL REACTION YIELDS IN THE GAS PHASE. Alfassi, Z. R. (Univ. of the Negev, Beersheba), Amiel, S. J. Inorg. Nucl. Chem.; 37: No. 3, 619-621(Mar 1975).

The calculation of fractional fission yields from the measured chemical yields of gas phase reaction products of fission fragments is discussed in terms of the kinetic theory of reactions of hot atoms. It is suggested that reactants and moderators should be chosen so that the average logarithmic energy decrements due to collisions with the reactant (α_r) and with the moderator (α_m) are approximately equal. If $\alpha_r \neq \alpha_m$ misleading conclusions could be reached. (auth)

7791 NUCLEAR ORIENTATION AND ANGULAR CORRELATION STUDIES OF GAMMA TRANSITIONS IN ^{151}Sm FROM THE DECAY OF ^{151}Pm. Warner, D. D.; Hamilton, W. D.; Fox, R. A.; Al-Janabi, T. (Univ. of Sussex, Eng.). J. Phys. G: Nucl. Phys.; 1: No. 2, 230-241(21 Feb 1975).

The levels and γ ray transitions in ^{151}Sm have been investigated using the two complementary techniques of directional correlation, and the directional distribution of radiation emitted by an oriented source. The orientation was produced using the hyperfine field in ferromagnetic gadolinium to polarize an ensemble of ^{151}Pm nuclei at a temperature of 11 mK. The resultant directional distribution of the γ rays was measured using high resolution Ge detectors. The correlation measurements used an intrinsic Ge detector in combination with a Ge(Li) detector. These two types of result enabled multipole mixing ratios to be determined for 34 γ transitions in the decay, and unambiguous spin assignments to be made for the levels connected by these transitions. This latter information in particular should make it easier to decide whether this nucleus can be described in terms of Nilsson single particle states. (auth)

7792 ROTATION-PARTICLE COUPLING EFFECTS IN LOW ENERGY NUCLEAR SPECTRUM OF ^{183}W. Sood, P. C.; Joshi, P. C. (Banaras Hindu Univ., India). J. Phys. G: Nucl. Phys.; 1: No. 2, 242-249(21 Feb 1975).

The deviations from I(I + 1) rule for K = 0 rotational bands are generally explained by writing a phenomenological expression with a power series in I(I + 1). For $K \neq 0$ bands the rotation-particle coupling (RPC or Coriolis) term in the Hamiltonian introduces an additional series which alternates in sign with level spin. The leading term of this alternating series for $K = \frac{1}{2}$ rotational bands can be said to arise from the third order RPC perturbation effects of $K = \frac{1}{2}$ states. These third order Coriolis perturbation effects have been calculated for the $\frac{3}{2}^-$ [512] based band in ^{183}W, by considering the mixing of all the possible $K^\pi = \frac{1}{2}^-$

states in the same oscillator shell. The matrix elements are calculated using the modified Nilsson model potential. The effect of the deformed spin-orbit coupling term is also investigated. The calculated coefficient is compared with its "experimental" value and the comparison is used to discuss the characterization of the non-adiabatic corrections. (auth)

Nuclear Properties and Reactions, 190 ≤ A ≤ 219

Refer also to abstracts 7704, 7727, 7734, 7749, 7768, 7779, 7789, 7790, 7806, 7850, and 7852.

7793 (CEA-CONF-2962) A SUITABLE TWO-CENTRE BASIS FOR SELF-CONSISTENT CALCULATIONS. Berger, J. F.; Gogny, D. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 92 - Montrouge (France)). 1974. 1p. INIS.

From international conference on nuclear structure and spectroscopy; Amsterdam, Netherlands (9 Sep 1974).

An extension to any deformation of the previous Hartree-Fock calculations for heavy nuclei is proposed. Instead of wave functions built from a two-centre potential, it is interesting to start directly from finite sets of harmonic oscillator functions centred at two points and to orthogonalize the basis thus obtained. (FR)

7794 (CEA-CONF-2963) HARTREE-FOCK DEFORMED CALCULATIONS IN THE RARE-EARTH REGION. Decharge, J.; Girod, M.; Cogny, D. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 92 - Montrouge (France)). 1974. 1p. INIS.

From international conference on nuclear structure and spectroscopy; Amsterdam, Netherlands (9 Sep 1974).

A phenomenological density dependent two body interaction, denoted as D1 was used in deformed Hartree-Fock (H. F.) calculations of s-d shell nuclei. Extensive deformed H. F. calculations are proved not to require very simplified parametrization of the interactions as has usually been done up to now. The interaction D1 is shown to behave very satisfactorily when applied to nuclei in the rare-earth region. (FR)

7795 (IC-74-65) SEMIMICROSCOPIC DESCRIPTION OF ODD At ISOTOPES. Paar, V. (International Centre for Theoretical Physics, Trieste (Italy)). Jul 1974. 25p. INIS.

The properties of odd At isotopes have been described by coupling three valence-shell protons to the quadrupole vibrational field. Qualitative and quantitative results have been compared with recent experimental data from the Dubna and Stockholm groups. It is interesting to note that two lowest $^1/_2^-$ states exchange their character in At nuclei away from the N = 126 shell closure. This pronounced feature of At isotopes is a combined effect of the particle-vibration coupling and the Pauli principle. (auth)

7796 MEASUREMENT OF ENERGY AND ANGULAR DEPENDENCE OF $\beta-\gamma$ CIRCULAR POLARIZATION CORRELATION OF ^{198}Au. Hartmann, F. J. Munich; Technische Univ. (1973). 54p. (In German). INIS.

Thesis.

An attempt was made to measure the $\beta-\gamma$ circular polarization correlation of the first forbidden β-minus decay of Au-198. Especially the validity of the so-called xi-approximation should be proved. There were no hints at invalidity of the xi-approximation at this decay up to now. The most sensitive test is the simultaneous measurement of energy and angular dependence of the $\beta-\gamma$-circular polarization correlation. The experimental arrangement at which the circular polarization of the γ- radiation is measured by the Compton forward scattering on magnetized iron runs automatically. The calibration of the arrangement was carried out by the $\beta-\gamma$-circular polarization correlation of Co-60. The analysis of the data shows a relative strong term of angular dependence how it should not appear at validity of xi-approximation. (GE)

7797 CALCULATION OF THE PAIRING VIBRATIONAL STATE OF ^{208}Pb USING TWO BODY POTENTIAL. Rudra, N.; Pal, M. K. (Saha Inst. of Nuclear Physics, Calcutta). pp 91-93 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Vol. 16B. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

7798 NEGATIVE PARITY STATES IN ^{195}Au. Ila, P.; Lakshminarayana, V. (Andhra Univ., Waltair, India). pp 172-173 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

7799 LEVEL STRUCTURE STUDIES IN ^{192}Pt AND ^{192}Os AND EXPERIMENTAL TEST OF PAIRING PLUS QUADRUPOLE MODEL. Singh, N.; Bhati, S. S.; Mangal, P. C.; Trehan, P. N. (Panjab Univ., Chandigarh, India). pp 214 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

Nuclear Properties and Reactions, A ≥ 220

Refer also to abstracts 6507, 7674, 7767, 7768, 7847, 7848, 7858, and 7896.

7800 (CEA-N-1700, pp 255-256) STUDIES AND DEVELOPMENT OF METHODS FOR ANALYSIS OF EXPERIMENTAL NEUTRON DATA. Tran Quoc Thuong; Ribon, P. 1973. (In French).

In progress report of the Nuclear Physics Department, 1 October 1972-30 September 1973.

Three statistical methods (the maximum likelihood method, moment method and using a least square criteria) have been developed and carefully tested with simulated χ^2 law distributions. A special emphasis is given to the values of the bias. The reduced neutron width distributions of ^{238}U and ^{232}Th are well represented by the chi-squared distribution with one degree of freedom, "The Porter-Thomas distribution." (auth)

7801 (CONF-741095-, pp 81-90) FISSION OF HEAVY ELEMENTS INDUCED BY HIGH-ENERGY PROTONS. Antanasijevic, R.; Todorovic, Z.; Juric, M. (Inst. of Physics, Belgrade, Yugoslavia). Oct 1974.

From proceedings of the triangle seminar; Beograd, Yugoslavia (28 Oct 1974).

In proceedings of the triangle seminar.

The binary and ternary fission of U, Th, Pb, Au and Pt induced by 12.2, 14, 18 and 23 GeV protons was analyzed with a polycarbonate detector. The basic characteristics of the binary and ternary fission of the elements mentioned are given, and the corresponding values of the cross sections are determined. (auth)

7802 (COO-2458-2) INTERACTIVE APPROACHES TO EVALUATING METHODS AND DATA FOR SELF-SHIELDED RESONANCE ABSORPTION. Becker, M. (Rensselaer Polytechnic Inst., Troy, N.Y. (USA). Dept. of Nuclear Engineering). 1975. Contract AT(11-1)-2458. 5p. (CONF-750323-1). Dep. NTIS $4.00.

From proceedings of ^{238}U resonance capture; Upton, New York, USA (18 Mar 1975).

When differential data are used to compute self-shielded resonance integrals, significant discrepancies arise. In order to infer specific causes of these discrepancies, a capability has been developed using interactive graphics. The system (Rensselaer Interactive Graphics Analysis System) possesses a variety of options that are useful in the construction of data files to be compared. It is concluded that an approach such as the interactive one would be desirable for dealing with the self-shielded resonance integral over both resolved and unresolved resonances. (SDF)

7803 (FRNC-TH-487) STUDY OF THE CROSS SECTIONS CORRESPONDING TO REACTIONS BETWEEN RESONANCE NEUTRONS AND ^{239}Pu. Derrien, H. (Paris-11 Univ., 91 - Orsay (France)). 1973. 201p. (In French). INIS.

Thesis.

The theory of the R matrix, which is the basis of formalisms used to analyze neutron cross sections in the resonance region, is reviewed together with the statistical properties of resonance parameters and the relations from which mean values can be obtained for these parameters. Time-of-flight techniques were used to measure total neutron cross sections and the fission cross sections for ^{239}Pu. The most important results concern S_0^+ and S_1^+ density functions ($S_0^+ = 1.3\ S_1^+$), mean radiative capture widths, and resonance fission widths. The large resonances observed in the cross sections correspond to a spin value of 0^+ and to large fission widths (2145 MeV); the fission occurring in these resonances is chiefly due to an open channel corresponding to the 0^+ transition state of the ground state rotational band. The mean fission width of the 1^+ state is considerably smaller (35.3 MeV). This width corresponds to fission beneath the threshold due to the double octupole vibration 1^+ state predicted by J. J. Griffin. The existence of an intermediate structure in the fission cross sections of the 1^+ channel was established from studies of the fluctuations in the 1^+ resonance fission widths over six energy intervals lying between 0 and 660 eV. This intermediate struc-

ture is explained in terms of a double maximum fission barrier occurring in the fission for values less than the 1^+ channel threshold. (auth)

7804 (UCID-16679) NEUTRON REACTIONS ON ^{239}U. Gardner, D. G. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 24 Apr 1975. Contract W-7405-Eng-48. 33p. Dep. NTIS $4.75.

Calculations were made of the major reactions induced by neutrons in the energy range of 10 eV to 2.5 MeV incident on ^{239}U. Both the 23.5 m $5/2^+$ ground state and the 0.78 mu s $1/2^+$ isomeric state of ^{239}U were considered as targets. The bulk of the calculations were performed with the COMNUC and UHL statistical model codes using Moldauer's optical-model parameters, although a rough correction for direct reactions was also made. The total, shape elastic, compound elastic, inelastic, capture, and fission cross sections are presented in tabular and graphic form over the specified neutron energy range. In addition, the fission cross sections were tentatively extrapolated down to thermal energy where they are compared with an unpublished measurement. For neutron energies above 500 keV the fission calculations are compared with predictions derived from published experimental measurements of the (t,pf) reaction on ^{238}U. (11 figures, 9 tables) (auth)

7805 (UCRL-51759) CALCULATED APPARENT YIELDS OF RARE GAS FISSION PRODUCTS. Delucchi, A. A. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 25 Feb 1975. Contract W-7405-Eng-48. 261p. Dep. NTIS $7.60.

The apparent fission yield of the rare gas fission products from four mass chains is calculated as a function of separation time for six different fissioning systems. A plot of the calculated fission yield along with a one standard deviation error band is given for each rare gas fission product and for each fissioning system. Those parameters in the calculation that were major contributors to the calculated standard deviation at each separation time were identified and the results presented on a separate plot. To extend the usefulness of these calculations as new and better values for the input parameters become available, a third plot was generated for each system which shows how sensitive the derived fission yield is to a change in any given parameter used in the calculation. (auth)

7806 SHORT-LIVED ISOTOPES OF ALKALI AND ALKALINE-EARTH ELEMENTS STUDIED BY ON-LINE ISOTOPE SEPARATOR TECHNIQUES. Ravn, H. L. (European Organization for Nuclear Research, Geneva); Sandell, S.; Westgaard, L.; Roeckl, E. J. Inorg. Nucl. Chem.; 37: No. 2, 383-393(Feb 1975).

Ion beams of many isotopes of Rb, Cs, Ba, Fr, and Ra have been produced at the ISOLDE facility, CERN, by bombarding heavy element targets with 600 MeV protons, followed by on-line surface ionization and electromagnetic mass separation. Overall production yields are reported, and the prospects for measuring formation cross-sections of short-lived nuclear species are discussed, taking the production of Cs from La as an example. The following half-lives of new nucleides have been determined: ^{75}Rb (21 ± 3) sec, ^{76}Rb (36.8 ± 1.5) sec, ^{116}Cs (3.6 ± 0.2) sec, ^{136m}Cs (19 ± 2) sec, ^{227}Fr (2.4 ± 0.2) min, ^{228}Fr (39 ± 1) sec, ^{229}Fr (39 ± 1) sec, ^{229}Fr (50 ± 20), sec ^{229}Ra (4.0 ± 0.2) min. The systematics of average beta (β^+, EC) strength functions has been updated. (auth)

7807 LIGHT PRODUCTS FROM 170 MeV PROTON INTERACTION WITH URANIUM. Alstad, J.; Haldorsen, I. R.; Pappas, A. C.; Skarestad, M. (Oslo Univ.). J. Inorg. Nucl. Chem.; 37: No. 4, 873-879(Apr 1975).

Formation cross sections for ^{24}Na, ^{28}Mg, ^{47}Ca and ^{59}Fe have been determined radiochemically in the 170 MeV p interaction with U and the lower part of the light wing of the mass distribution is established. The curve follows the trend previously found for U(170 MeV p,f) down to A ≅ 40, passes through a minimum and shows a steep rise below A = 30. Possible reaction mechanism/modes leading to ^{24}Na and ^{28}Mg are discussed, i.e., extreme asymmetric fission, cascade-fission, fragmentation and ternary fission, with the latter as the most probable. (auth)

7808 INDEPENDENT YIELDS OF ^{84}Rb, ^{86}Rb, AND ^{136}Cs, FOR THERMAL-NEUTRON-INDUCED FISSION OF ^{233}U, ^{235}U, AND ^{239}Pu. Flynn, K. F.; Glendenin, L. E. (Argonne National Lab., IL). J. Inorg. Nucl. Chem.; 37: No. 4, 869-872(Apr 1975).

The independent fission yields of ^{84}Rb (a positron emitter), ^{86}Rb and ^{136}Cs have been measured for thermal-neutron-induced fission of ^{233}U, ^{235}U and ^{239}Pu. The yields of ^{84}Rb are (6.6 ± 0.7) × 10^{-8}% for ^{233}U, (2.4 ± 0.3) × 10^{-9}% for ^{235}U, and (3.9 ± 0.4) × 10^{-8}% for ^{239}Pu. The yields of ^{86}Rb are (9.2 ± 0.9) × 10^{-4}% for ^{233}U, (2.1 ± 0.2) × 10^{-5}% for ^{235}U, and (1.9 ± 0.2) × 10^{-4}% for ^{239}Pu. The yields of ^{136}Cs are 0.105 ± 0.011% for ^{233}U, 0.0074 ± 0.0007% for ^{235}U, and 0.100 ± 0.010% for ^{239}Pu. The half-life of ^{136}Cs by least squares analysis of the decay of eleven independent samples is 13.16 ± 0.03 days. (auth)

7809 MASS DISTRIBUTION FOR SPONTANEOUS FISSION OF ^{252}Cf. Flynn, K. F.; Gindler, J. E.; Glendenin, L. E. (Argonne National Lab., IL). J. Inorg. Nucl. Chem.; 37: No. 4, 881-885(Apr 1975).

The distribution of mass in the spontaneous fission of ^{252}Cf has been investigated by the radiochemical determination of the fission yields for 35 mass chains. Absolute fission yields were measured for four nuclides, ^{99}Mo, ^{111}Ag, ^{132}Te and ^{140}Ba. Ratios of the yields of fission product isomers to total chain yields were determined for ^{115g}Cd, ^{125g}Sn, ^{127m}Te and ^{129m}Te. A comparison of this work with that of previous investigators has resulted in "recommended" yields for 51 mass chains. (auth)

7810 CHARGE SEPARATION OF THE FISSION FRAGMENTS IN THE MASS RANGE 80 ≤ A ≤ 115. Fossati, F.; Pinelli, T. (Univ., Pavia, Italy). Lett. Nuovo Cim.; 12: No. 15, 561-566 (12 Apr 1975).

The preliminary results on the measurement of the charge distribution of the light fragments resulting from the spontaneous fission of ^{252}Cf using an experimental procedure which essentially makes use of the range-energy relationship for heavy ions are reported. The results obtained in the preliminary data reduction seem to indicate that the method used can be suitable for separating at least the predominant charges of the fragments with a given mass number A. (3 figures, 2 tables) (SDF)

7811 NUCLEAR CHARGE DISTRIBUTION OF HEAVY FISSION PRODUCTS FROM LOW ENERGY FISSION OF ^{236}U AND ^{240}Pu. Gunther, H. Munich; Technische Univ. (1972). 115p. (In German). INIS.

Thesis.

Fission products of uranium-235 and plutonium-239 induced by thermal neutrons were separated in masses and energies by a mass spectrometer of the Mattauch-Herzog type. The aim of the experiment was the determination of the primary nuclear charge distribution in the region of the most abundant masses of heavy fission products from A = 131 to A = 140. For that the number of β-particles were measured, which each single fission product of known mass emits in a nuclear track emulsion up to achievement of a stable nuclide. The results were compared with other experimental and theoretical values. As for uranium-235 that experiment results in an increased yield of the doubly magic nucleus Sn-132 (N = 82, Z = 50) for plutonium-239. At least for uranium-235 that is in contradiction to the most radiochemical results. The structure effects in the yield of the fission fragments are discussed in detail. (GE)

7812 NUCLEAR CHARGE DISTRIBUTION IN FISSION-SPECTRUM-NEUTRON INDUCED FISSION: FRACTIONAL CUMULATIVE YIELDS OF RARE GAS NUCLIDES FROM FISSION OF ^{235}U AND ^{238}U. Wolfsberg, K. (Los Alamos Scientific Lab., NM). J. Inorg. Nucl. Chem.; 37: No. 5, 1125-1128(May 1975).

The fractional cumulative yields of a number of krypton and xenon products from slightly degraded fission-spectrum-neutron fission of ^{235}U and ^{238}U have been measured using the emanation technique. The values and other measurements are consistent with the model that has been developed for charge distribution in thermal-neutron fission of ^{235}U. (auth)

7813 TRIPLE FISSION OF NUCLEI IN LIQUID-DROP MODEL. Diehl, H. Frankfurt am Main; Univ. Frankfurt am Main (1973). 65p. (In German). INIS.

Thesis.

An attempt is made to get information about triple fission using liquid drop model. The fission through oblate barrier is analyzed firstly in detail. The potential barriers to penetrate are given as a function of the fission parameters. (GE)

7814 SEARCH FOR SUPERHEAVY ELEMENTS IN IRON-MANGANESE NODULES. Flerov, G. N.; Vyropayev, V. Ya.; Getskin, L. S.; Popeko, A. G.; Skobelev, N. K.; Ter-Akop'yan, G. M.; Tsyb, P. P. (Joint Inst. for Nuclear Research, Dubna, USSR). Yadern. Fiz.; 21: No. 1, 9-13(Jan 1975). (In Russian).

The search for superheavy elements in iron-manganese nodules is carried out. We have also studied the sublimation products and the products of chemical separation enriched with heavy elements from nodules. The limit values of T/C for heavy analogs of mercury, thallium, lead and bismuth are obtained for the products under investigation. (4 tables) (auth)

7815 DESCRIPTION OF EXPERIMENTAL DATA ON UNDER-BARRIER FISSION IN THE MODEL OF TWO-BUMP BARRIER. Marshalkin, V. E.; Tyapin, A. S. Yadern. Fiz.; 21: No. 1, 14-19 (Jan 1975). (In Russian).

An expression is presented for the total fission penetration of the two-bump barrier with the imaginary part as a sum of the direct penetration and a resonance term, describing the nuclear fission through the intermediate states in the second well. Taking

the fission of ^{240}Pu induced by slow neutrons, as an example, the possibility of describing simultaneously the total available experimental information on the under-barrier fission is shown. Remarks on accuracy of determination of parameters for the two-bump fission are presented. (1 table, 2 figures) (auth)

7816 PERTURBATION OF $\alpha-\gamma$ ANGULAR CORRELATIONS IN A GASEOUS MEDIUM. Do Ngoc, B.; Liang, C. F. (Centre National de la Recherche Scientifique, 91- Orsay (France). Centre de Spectrometrie Nucleaire et de Spectrometrie de Masse). J. Phys. (Paris).; 35: No. 10, 693–698(Oct 1974). (In French).

Perturbed $\alpha-\gamma$ angular correlations were measured in the decay of ^{224}Ra to ^{220}Rn. Thin sources were used. The recoiling daughter ions were allowed to escape into helium and air under different pressures. The perturbation is explained by a time-dependent magnetic interaction. (auth)

7817 RECOIL-DISTANCE LIFETIME MEASUREMENTS AND MULTIPLE COULOMB EXCITATION STUDIES OF ^{236}U. Guidry, M. W. Knoxville, TN; Univ. of Tennessee (1974). 203p. University Microfilms Order No. 75-3601.

Thesis (Ph. D.).

Recoil-distance lifetime measurements and multiple Coulomb excitation studies have been performed for the 4^+, 6^+, 8^+, 10^+, and 12^+ members of the ^{236}U ground-state rotational band. The recoil-distance data were analyzed with a theoretical correction procedure that was developed during the course of this work and implemented in a computer code ORACLE. The half-lives determined by the recoil-distance technique were 124.0 +- 7.3 ps (4^+), 58.2 +- 3.3 ps (6^+), 23.9 +- 1.9 ps (8^+), 11.6 +- 1.1 ps (10^+), and 5.5 +- 2.2 ps (12^+). These correspond to B(anti E2, I/sub i/ yields I/sub i/ - 2)/e^2b^2 values of 3.03 +- 0.20 (4^+), 3.28 +- 0.19 (6^+), 3.42 +- 0.28 (8^+), 3.11 +- 0.30 (10^+), and 3.34 +- $^{0.95}_{2.23}$ (12^+). Transition quadrupole moments Q_{20}(I/sub i/ yields I/sub f/) extracted from the B(E2) values are constant within experimental error and support the interpretation of ^{236}U as a good rotor for I/sup pi/ less than or equal to 12^+. The comparison of multiple Coulomb excitation probabilities with those predicted by theory has confirmed the sign of the E4 moment in ^{236}U as positive. This is in agreement with theoretical predictions and resolves ambiguity in the sign of the moment as determined by alpha-particle Coulomb excitation. The success of this work has demonstrated that recoil-distance measurements and multiple Coulomb excitation are important complementary techniques in the study of high-spin rotational states. The code ORACLE should prove valuable in future studies of this type due to its essentially rigorous treatment of recoil-distance data. (Diss. Abstr. Int., B)

7818 LEVEL DENSITY PARAMETERS FOR SUPERHEAVY NUCLEI. Ghosh, S. K.; Chatterjee, A. (Saha Inst. of Nuclear Physics, Calcutta). pp 1-4 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Vol. 16B. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

7819 RECOIL RANGES AND KINETIC ENERGY DISTRIBUTIONS IN REACTOR NEUTRON FISSION OF ^{232}U AND ^{237}Np AND THERMAL NEUTRON FISSION OF ^{241}Pu. Manohar, S. B.; Ramaswami, A.; Dange, S. P.; Prasanna Venkatesan, P.; Prakash, S.; Ramaniah, M. V. (Bhabha Atomic Research Centre, Trombay, India). pp 5-8 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Vol. 16B. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

7820 FISSION FRAGMENT MASS VERSUS ANGLE CORRELATION IN FAST NEUTRON FISSION OF URANIUM 235. Ajitanand, N. N.; Choudhary, R. K.; Murthy, S. R. S.; Rama Rao, P. N.; Kapoor, S. S. (Bhabha Atomic Research Centre, Trombay, India). pp 9-12 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Vol. 16B. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

7821 POSSIBLE INFLUENCE OF THE 28 PROTON SHELL ON FISSION MASS DISTRIBUTION. Marathe, S. G.; Sahakundu, S. M.; Bhargava, V. K.; Rao, V. K.; Iyer, R. H. (Bhabha Atomic Research Centre, Trombay, India). pp 21-24 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Vol. 16B. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

7822 ELECTRIC MONOPOLE TRANSITION IN ^{228}Th. Devare, S. H.; Devare, H. G. (Tata Inst. of Fundamental Research, Bombay). pp 195-198 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

7823 STRONG ABSORPTION CALCULATIONS FOR THE PRINCIPAL FISSILE AND FERTILE NUCLEI. Satyanarayana, U.; Ramamurty, S. (Andhra Univ., Waltair, India). pp 215 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

7824 FINE-STRUCTURE IN THE MASS-YIELD CURVE FOR BINARY FISSION. A Possible Secondary Effect. Feather, N. (Univ. of Edinburgh, Eng.). Proc. Roy. Soc. Edinburgh, Sect. A; 71: 333-336(1974).

The recent suggestion that the short-range α-particles of fission are emitted predominantly from post-neutron-emission fragments in the mass number range 140 to 145 is shown to have implications in relation to the fine structure of the mass-yield curve. An examination of mass-yield curves discloses, in many of them, a fine structure feature of the type predicted. (auth)

7825 TIME DEPENDENT ^{237}Np, ^{235}U, AND ^{239}Pu FISSION RATES IN A Th ASSEMBLY DURING THE INTERVAL 0 TO 200 NS USING A PULSED ^{9}Be(d,n) SOURCE. II. Theory. Moo, S. P. (Tasmania Univ., Sandy Bay, Australia); Rainbow, M. T.; Ritchie, A. I. M. J. Phys., D (London); 7: No. 18, 2511-2524 (11 Dec 1974).

Calculations are presented of the ^{237}Np, ^{235}U and ^{239}Pu fundamental mode fission rates in a thorium assembly based on a diffusion theory code with a DB^2 leakage term. Three different Th cross section sets were derived from the ABBN set; the UKNDL68 file and the ENDF/B-II file were used in the calculations and the results compared with each other and with experimental results reported previously. The sensitivity of the instantaneous decay constant of the fundamental mode to changes in partial cross sections is investigated. (auth)

7826 CALORIMETRIC MEASUREMENT OF ALPHA HALF-LIFE OF ^{242}Cm. Kerrigan, W. J.; Banick, C. J. (Du Pont de Nemours (E. I.) and Co., Aiken, SC). J. Inorg. Nucl. Chem.; 37: No. 3, 641-643(Mar 1975).

The alpha half-life of ^{242}Cm was found to be 163.2 ± 0.4 days by calorimetric determination of the change in power of two curium oxide sources over a period of 287 days. (auth)

7827 ISOMER RATIO ^{236}Np(1)/^{236}Np(s) IN THE REACTION ^{237}Np(n,2n)^{236}Np FROM NEUTRONS PRODUCED IN THERMONUCLEAR DEVICES. Myers, W. W.; Lindner, M.; Newbury, R. S. (Univ. of California, Livermore). J. Inorg. Nucl. Chem.; 37: No. 3, 637-639(Mar 1975).

The ratio of the long-lived to the 22-hr isomer of ^{236}Np was measured for the reaction ^{237}Np(n,2n)^{236}Np by exposing ^{237}Np to the neutron spectra produced in underground thermonuclear tests. The average value of this ratio was found to be 0.35 ± 0.05. (auth)

7828 EFFECT OF ANGULAR MOMENTUM AND EXCITATION ENERGY ON SCISSION POINT PARAMETERS IN FISSION OF ^{239}Pu/sup */. Cuninghame, J. G.; Goodall, J. A. B. (United Kingdom Atomic Energy Authority, Harwell, Eng.). J. Phys. G: Nucl. Phys.; 1: No. 2, 250-262(21 Feb 1975).

The compound nucleus ^{239}Pu* has been formed by bombardment of ^{235}U and ^{236}U by ^{4}He and ^{3}He projectiles respectively. Bombarding energies were adjusted so that the effects of both excitation and angular momentum of the compound nucleus on scission point parameters could be observed. An unexpectedly strong effect, seemingly too large to be due to angular momentum, is apparently caused by some unidentified difference between reactions in which ^{3}He and ^{4}He are the projectiles. A correlation between mean total kinetic energy of the fission fragments and the fissility parameter and excitation energy of the compound nucleus is given which allows the estimation of <TKE> to ±2 MeV for any system fissioned by charged particles. (auth)

7829 DISTRIBUTION OF FISSION YIELDS IN THE 14.8 MeV NEUTRON-INDUCED FISSION OF ^{238}U. Adams, D. E.; James, W. D.; Beck, J. N.; Kuroda, P. K. (Univ. of Arkansas, Fayetteville). J. Inorg. Nucl. Chem.; 37: No. 2, 419-424(Feb 1975).

The mass yield distribution for the 14.8 MeV neutron-induced fission of ^{238}U has been measured radiochemically for 46 mass chains in the region A = 83 to 157. The absolute activities of each nuclide measured in this mass region were determined by

gross beta counting and the cumulative fission yields were measured relative to ^{99}Mo. The yields determined in this work are compared to all known literature values. Eleven fission yields are presented that have been experimentally measured for the first time for the 14.8 MeV neutron-induced fission of ^{238}U. The yields measured make up about 115% of the total of 200% expected from fission. As reported previously in the literature, fine structure was observed to exist at mass number 134 and no clear evidence could be found for fine structure at other mass numbers. (auth)

Nuclear Theory

Refer also to abstracts 7561, 7622, 7647, 7682, 7683, 7707, 7721, 7724, 7792, 7805, and 7813.

7830 (BNL-19842) CLUSTER STATES IN LIGHT NUCLEI IN A FOLDED POTENTIAL MODEL. Buck, R.; Dover, C. B.; Vary, J. P. (Brookhaven National Lab., Upton, N. Y. (USA)). Mar 1975. 3p. (CONF-750447-1). Dep. NTIS $4.00.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

A model is outlined for three and four particle cluster states in light nuclei, in which such states are considered as bound states and resonances of a cluster-core folded potential. The energy spectra, B(E2) values, alpha widths and r.m.s. radii of these states are calculated for ^{16}O and ^{20}Ne, and are in good agreement with experiment. The model is also used to provide dynamical support for high spin assignments for states in ^{15}N and ^{15}O seen strongly in heavy ion three particle transfer reactions. The model is also useful as a predictive tool in estimating the energies of other high spin cluster states in a variety of nuclei. (1 figure, 1 table) (auth)

7831 (IC-73-168) DEPENDENCE OF PAIRING STRENGTH ON DEFORMATION. Gabrakov, S.; Bochnacki, Z.; Balbutsev, E. (International Centre for Theoretical Physics, Trieste (Italy)). Nov 1973. 6p. INIS.

The dependence of pairing strength on the nuclear deformation is investigated in the framework of the volume-conserving pairing theory and pairing strength proportional to the nuclear surface area, and the results obtained are compared. (auth)

7832 (IC-74-71) DWBA ANALYSIS OF HEAVY ION TRANSFER REACTIONS-II. Ann, R.; Taffara, L. (International Centre for Theoretical Physics, Trieste (Italy)). Jul 1974. 20p. INIS.

In order to evaluate recoil effects approximately, the possibility of obtaining a series expansion in $\alpha = \mu_x/\mu_B$ of the DWBA-matrix element for the transfer reaction (a + x) + b → (b + x) + a is discussed. It is found that an approximate but convergent series of the partial wave matrix element at fixed angular momenta can be obtained if both the contributions from small r_{bA} and large r_{ax} are discarded. The explicit expression of the N-th order in α is also given and the limit of applicability of such an expansion is discussed. (auth)

7833 (JINR-P1-8662) CENTRAL COLLISION OF RELATIVISTIC NUCLEI. Tolstov, K. D. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 11p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The models of relativistic nuclei interactions at central collisions are discussed for the purpose of running experiments at accelerators. The data of these models are compared with the results of investigations with cosmic rays. (auth)

7834 (JINR-P2-8557) MULTIPLICITY OF SECONDARY PARTICLES IN INCLUSIVE HADRON-NUCLEUS REACTIONS. Grishin, V. G.; Eliseev, S. M.; Inogamova, T. Ya. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 15p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The mean multiplicities of secondary particles produced in the interactions of hadrons with nuclei at high energies is presented. It is shown that a simple cascade model does not explain available experimental data already at $E \gtrsim 30$ GeV. Two possible improvements of the model are considered: the introduction of many-body interactions and taking into account the effect of decreasing the cross section of the interaction of leading particles inside the nucleus. These changes permit one to describe the experimental data. (auth)

7835 (JINR-P4-8416) ROLE OF NONADIABATIC EFFECTS IN THE COULOMB INTERACTION OF COMPLEX NUCLEI. Dzholos, R. V.; Permyakov, V. P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 21p. (In Russian). Dep. NTIS (US Sales Only) $4.25.

The method of taking into account the nonadiabatic effects in the Coulomb interaction of the complex nuclei is developed without using the perturbation theory or strong binding of a small number of channels. A series of unitary transformations of an initial Hamiltonian (that allows for the connection of the relative nucleus motion with the intraexcitations of a collective type) resulted in an approximate separation of variables. In this case a one-dimensional Schrödinger equation with the renormalized initial nucleus potential and the collective nucleus parameters is obtained. (1 table) (auth)

7836 (JINR-P4-8591) EXACTLY SOLUBLE MODEL FOR VOLUME CONSERVING PAIRING. Bal'butsev, E. B.; Ploshaichak, M. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 12p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

Exactly soluble model for volume conserving pairing is formulated. It is shown, that nonzero equilibrium energy gap exists only in nuclei having irregularities in spectra near Fermi surface. (auth)

7837 (JINR-P4-8611) STUDY OF VIBRATIONAL STATE UNHARMONICITY IN STRONGLY DEFORMED NUCLEI. Kyrchev, G.; Solov'ev, V. G.; Stoyanov, Ch. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 13p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The role is studied of the two-phonon component admixture in the wave functions of the first and second vibrational states with a given K^π for even-even deformed nuclei. The calculations are performed with one-particle energies and wave functions of the Saxon-Woods potential taking into account, at the same time, three one-phonon components. The first vibrational states with $K^\pi \neq 0^+$ are shown to be, practically, one-phonon. For the second states two-phonon admixtures are more essential. (5 tables) (auth)

7838 (UCRL-75991) USE OF NUCLEAR REACTION MODELS IN CROSS SECTION CALCULATIONS. Grimes, S. M. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Mar 1975. 27p. (CONF-741088-2). Dep. NTIS $4.50.

From American Physical Society, division of nuclear physics; Pittsburgh, Pennsylvania, USA (31 Oct 1974).

The design of fusion reactors will require information about a large number of neutron cross sections in the MeV region. Because of the obvious experimental difficulties, it is probable that not all of the cross sections of interest will be measured. Current direct and pre-equilibrium models can be used to calculate non-statistical contributions to neutron cross sections from information available from charged particle reaction studies; these are added to the calculated statistical contribution. Estimates of the reliability of such calculations can be derived from comparisons with the available data. (3 tables, 12 figures) (auth)

7839 PARTICLE-HOLE MATRIX ELEMENTS OF THE SKYRME INTERACTION. Blaizot, J. P.; Raynal, J. (CEN, Saclay, France). Lett. Nuovo Cim.; 12: No. 13, 508-512 (29 Mar 1975).

Antisymmetrized particle-hole matrix elements are considered for the Skyrme interaction. Geometrical coefficients are calculated and radial operators are constructed for different terms of the force and for natural and unnatural parity matrix elements. (1 table) (SDF)

7840 CALCULATION OF DENSITY LEVELS OF ROTATED DEFORMED NUCLEI. Voronov, V. V.; Malov, L. A.; Solov'ev. (Joint Inst. for Nuclear Research, Dubna, USSR). Yadern. Fiz.; 21: No. 1, 40-43 (Jan 1975). (In Russian).

The effect of the rotation on the density of excited levels of deformed nuclei is studied. It is shown that the rotation essentially improves the description of the density of high spin states. The density spin dependence is considered. At excitation energies higher than 4 MeV it has turned to be similar to the dependence followed from the statistical model. It is shown that the semiclassical approach with rotation and vibration describes well the densities of excited states of deformed nuclei at the neutron binding energy B_N. (2 figures, 1 table) (auth)

7841 DEORIENTATION OF A NUCLEUS AND ANGULAR DISTRIBUTION OF γ QUANTA IN REACTIONS WITH HIGH INTRODUCED MOMENTUM. Khien, F. Z. (Joint Inst. for Nuclear Research, Dubna, USSR). Yadern. Fiz.; 21: No. 1, 44-50 (Jan 1975). (In Russian).

Deorientation of the nuclear spin due to the evaporation of neutrons and to γ radiation in reactions with high introduced momentum is considered. The orientation of the nucleus in the states of continuous spectrum is described by the Gaussian distribution of the spin projection on the direction of the beam. Simple formulae are obtained for the diffuseness parameter of the distribution. Proceeding from the results, a method is developed to calculate the spin orientation of the residual nuclei and the angular distribution of γ quanta in the discrete spectrum.

The dependence of the orientation of the nucleus and of the anisotropy of the angular distribution upon the energy of bombarding particles, upon the mass of the nucleus and upon the characteristics of the state under consideration is discussed. The proposed method can be used to study the mechanism of populating the states of the residual nuclei and to identify their characteristics (in particular, to identify the spins of spontaneously fissioning isomers by means of measuring the angular distribution of fragments). (1 table, 1 figure) (auth)

7842 EXCHANGE INTERACTION OF RESONANCE STATES. Dalidchik, F. I. (Inst. of Chemical Physics, Moscow). Yadern. Fiz.; 21: No. 1, 51-61(Jan 1975). (In Russian).

Exact algebraic equations are derived for the quantities which determine the levels of stationary and quasistationary states, wave functions and the Green function of a particle in a field of arbitrary fixed interaction centers. The obtained equations are used to analyze the properties of exchange interaction of single-nucleon quasistationary states. (auth)

7843 ROLE OF DYNAMICAL NUCLEON CORRELATIONS IN PROCESSES OF INCOHERENT PHOTOPRODUCTION OF MESONS ON NUCLEI. Gevorkyan, S. R.; Matinyan, S. G.; Solakhyan, V. P. Yadern. Fiz.; 21: No. 1, 62-66(Jan 1975). (In Russian).

Effect of dynamical nucleon correlations on differential cross sections of the incoherent processes of $\pi^{\pm}$-meson photoproduction processes on nuclei at high energies is investigated. Two cases limiting in the energy are considered in detail. A consequence of the present work is that main contribution to the correction due to the correlations is from the interaction between the nucleons on which the production or the elastic scattering occurs, while contributions from such processes compensate one another in a nontrivial way, so that the correction due to the nucleon correlations does not exceed 5%. (auth)

7844 CONTRIBUTION FROM COLLECTIVE MOTIONS TO THE DENSITY OF NUCLEAR EXCITED STATES. Ignatyuk, A. V. Yadern. Fiz.; 21: No. 1, 20-30(Jan 1975). (In Russian).

Secular equations, determining the energy of coherent motions of particles in highly-excited nuclei, are obtained by means of the two-time temperature Green's functions, split in the random phase approximation. Additional terms are calculated in the thermodynamical nuclear functions, that determine the statistical characteristics of the collective (phonon) excitation branch and influence correspondingly the density of states in the excited nuclei. (3 figures) (auth)

7845 CALCULATION OF CROSS SECTIONS FOR THE PION PHOTOPRODUCTION ON ATOMIC NUCLEI IN THE OSCILLATOR SHELL MODEL. Shebeko, A. V. (Physical Tech. Inst., Moscow). Yadern. Fiz.; 21: No. 1, 82-88(Jan 1975). (In Russian).

Angular and energy distributions of pions produced in photoproduction reactions on atomic nuclei are calculated. Interaction of γ quanta with nuclei is considered basing on the impulse approximation, while for description of interaction of the produced pions with the nucleus the optical model is applied. The oscillator shell model is used in the calculations to describe both the initial and final nuclear states. (2 figures, 1 table) (auth)

7846 SIMPLE HIGH-ENERGY REACTIONS ON COMPLEX NUCLEI. Church, L. B. (State Univ. of New York, Buffalo). pp 197-220 of Radiochemistry. Maddock, A. G. (ed.). London; Butterworths (1975).

The subject is reviewed in chapters, entitled: proton-induced simple reactions (nuclear structure, isomeric states, isobaric analog state, integral recoil, differential energy recoil, differential angular distribution, emission of pions, emission of light nuclei, anti-proton-induced reactions); high-energy neutron-induced reactions; deuteron-induced reactions; helium-ion-induced reactions. (UK)

7847 TRAJECTORY CALCULATIONS IN ALPHA PARTICLE-ACCOMPANIED FISSION AND STUDY OF SCISSION CONFIGURATION. Choudhury, R. K.; Ramamurthy, V. S. (Bhabha Atomic Research Centre, Trombay, India). pp 13-16 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Vol. 16B. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

7848 TRAJECTORY CALCULATIONS ON LONG RANGE ALPHA FISSION. Krishnarajulu, B.; Gadgil, A. J.; Mehta, G. K. (Indian Inst. of Technology, Kanpur). pp 17-20 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Vol. 16B. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

7849 CALCULATION OF THE NUCLEAR DEFORMATION ENERGIES FROM THE RENORMALIZED GAS MODEL. Mukherjee, S.; Chatterjee, A. (Saha Inst. of Nuclear Physics, Calcutta). pp 25-26 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Vol. 16B. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

7850 EFFECT OF DEUTERON BREAK-UP CHANNEL ON SINGLE PARTICLE TRANSFER REACTIONS. Roy, S. K. (Saha Inst. of Nuclear Physics, Calcutta); Ray, S.; Samaddar, S. K.; Mukherjee, S. pp 42-44 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Vol. 16B. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

7851 EFFECT OF EXCHANGE ON THE EQUIVALENT SHARP RADIUS FOR REAL PROTON OPTICAL POTENTIAL. Srivastava, D. K.; Ganguly, N. K. (Bhabha Atomic Research Centre, Trombay, India). pp 45-48 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Vol. 16B. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

7852 EFFECT OF THE COULOMB INTERACTION ON PROTON OPTICAL POTENTIAL. Samaddar, S. K.; Ray, S. (Chander-nagore Coll., Hooghly, India). pp 49-52 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Vol. 16B. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

7853 VALIDITY OF GLAUBER THEORY. Banerjee, H.; Dutta-Roy, B.; Sharma, S. K. (Saha Inst. of Nuclear Physics, Calcutta). pp 61-63 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Vol. 16B. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

7854 NOTE ON THE ANGULAR MOMENTUM ANALYSIS OF THE JJ COUPLING SHELL MODEL. II. Rao, A. S. (Andhra Univ., Waltair, India). pp 114 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

7855 NEW GOOD QUANTUM NUMBER IN COLLECTIVE MODEL. Sharma, S. D. (Punjab Univ., Patiala, India). pp 115-117 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

7856 STATE DENSITIES WITH FIXED QUADRUPOLE MOMENT. Haq, R.; Parikh, J. C. (Physical Research Lab., Ahmedabad, India). pp 118-121 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

7857 ROTATIONAL FLOW MODEL AND ITS SIGNIFICANCE. Prakash, V. R.; Deshpande, V. K. (Indian Inst. of Technology, Kanpur). pp 126-129 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

7858 ENTROPY METHOD FOR OBTAINING RELATIVE SHELL CORRECTION ENERGIES OF NUCLEI AND THE CALCULATION OF FISSION BARRIERS. Ramamurthy, V. S.; Kapoor, S. S. (Bhabha Atomic Research Centre, Trombay, India). pp 130-133 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

7859 MINIMIZATION OF ENERGY VARIANCE FOR DETERMINANTS. Satyan, V.; Parikh, J. C. (Physical Research Lab., Ahmedabad, India). pp 134-136 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

7860 IMPROVED ESTIMATE OF SU(4) SYMMETRY MIXING IN LIGHT NUCLEI. Haq, R.; Parikh, J. C.; Bhatt, K. H. (Physical Research Lab., Ahmedabad, India). pp 138 of Proceedings of the Nuclear Physics and Solid State Physics Symposium, Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

7861 ASYMMETRIC ROTOR MODEL WITH ANGULAR-MOMENTUM DEPENDENT MOMENTS OF INERTIA. Samanta, B. C.; Banerjee, P. K. (Burdwan Univ., W. Bengal, India). pp 140 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

7862 TOTAL NEUTRON EMISSION CROSS-SECTIONS. Kondaiah, E. (Tata Inst. of Fundamental Research, Bombay); Athougies, A. L. pp 216-217 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

7863 OFF-ENERGY-SHELL BEHAVIOR OF THE NUCLEON–NUCLEON INTERACTION. Srivastava, M. K. (Univ., Roorkee, India). pp 294-329 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

Considerable effort has been directed during the past few years at a number of places toward the understanding of the off-energy-shell behavior of the nucleon–nucleon interaction. The principal uncertainties in the off-energy-shell reaction matrix are pointed out, and the methods developed to analyze the effects of the various features of the interaction are reviewed. The results of the various many-body calculations are discussed with a view to showing how far these studies have been successful in fixing the off-energy-shell behavior. Finally, the present status of the understanding of the off-energy-shell properties of the nuclear force are discussed; and the possible future lines of attack, both theoretical and experimental, are suggested. (auth)

7864 EXAMINATION OF THRESHOLD PHENOMENA WITHIN THE FRAMEWORK OF A MODEL WITH AN EXACT SOLUTION. Ervin, D. (Central Research Inst., Budapest). Magy. Fiz. Foly.; 22: No. 5, 401-445(1974). (In Hungarian).

The behavior of cross section was studied in an energy range, in which a previously forbidden channel becomes energetically possible, designating the anomalies encountered there as threshold phenomena. The anomalies were identified as the so-called Wigner cusps. It was attempted to derive a model yielding an exact solution in order to examine the interaction of threshold phenomena and resonances, i.e., searching for an answer concerning the behavior of a cross section near a threshold, if there is a one-particle, doorway or compound resonance. It was concluded on the basis of the observed cusps that a strong threshold effect may be expected when the opening channel takes away a large particle flux from the other channels. This occurs when the opening channel has a simple structure, there is a one-particle resonance near the threshold and the channel in question is strongly connected with the other investigated channels. The assumption was supported by numerical calculations. The threshold phenomena predicted by Wigner were examined, finding that they indeed exist but the rapid change of the cross section may suppress or enhance them. (TTT) (Doctoral dissertation)

7865 FDSM APPROACH TO SUB-COULOMB NEUTRON TRANSFER REACTIONS. Dolinskii, E. I.; Mukhamedzhanov, A. M. (Moscow State Univ.). J. Phys. G: Nucl. Phys.; 1: No. 2, 195-202(21 Feb 1975).

The Feynman diagram approach to sub-Coulomb neutron transfer reactions is discussed and compared with the distorted wave Born approximation. (auth)

PHYSICS (RADIATION AND SHIELDING)

Radiation Physics

Refer also to abstracts 6424, 6592, 6671, 6693, 6700, 6701, 7393, 7394, and 7711.

7866 (CEA-R-4614) AN APPLICATION OF THE DRIFT TIME METHOD TO THE STUDY OF EVOLUTION OF IONS OF RADIOCHEMICAL ORIGIN. Krien, P. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Protection; Paris-6 Univ., 75 (France)). Oct 1974. 86p. (In French). INIS.

The variation of the mobility of ions created by α or β ionization was studied as a function of their contact time with filtered atmospheric air; it was shown that small ions (mobility higher than 1 $cm^2 \cdot V^{-1} \cdot s^{-1}$) and intermediate ions (mobility lower than 1 $cm^2 \cdot V^{-1} \cdot s^{-1}$) followed the same variation laws. It was demonstrated experimentally that (1) the nature of the ionization source did not play on the formation of intermediate ions, (2) observation of this class of ions was subjected to the measuring technique used. It was finally demonstrated that the formation and evolution of intermediate ions required the presence of a nucleogenic impurity. (FR)

7867 (CEA-R-4655) DOSIMETRIC AND MICRODOSIMETRIC INVESTIGATIONS ON HIGH L.E.T. PARTICLE BEAMS. Bridier, A.; Fache, P. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Protection). Mar 1975. 231p. (In French). Dep. NTIS (US Sales Only) $14.75.

Thesis. Submitted to Toulouse Univ., France.

A study was made on high L.E.T. particle beams: 650 MeV-helions obtained in the Synchrotron Saturne (Saclay) and neutrons obtained by interactions of 16, 33, and 50 MeV deuterons with a thick beryllium target in the Cyclotron of the University of Louvain. The theoretical and mathematical approach of energy imparted to tissues by helions is presented, and the microdosimetric quantities and principles are precised. Then, a description is given of the experimental design and the detectors or dosemeters used: ionization chambers, proportional counter, junction. Finally the experimental results of both types of beams are given. They concern the dose distribution in a tissue equivalent medium from the microdosimetric and dosimetrical points of view. In the case of helion beams, the dose distribution was studied by using a ridge filter allowing to obtain a dose plateau at 15 cm depth. An application of microdosimetric results to biological data is presented in the case of neutron beams. (auth)

7868 (CONF-740985-, pp 91-94) ENERGY SHARING IN COMPOUNDS UNDER HEAVY ION BOMBARDMENT. Andersen, N.; Sigmund, P. (Oersted Inst., Copenhagen). 1974.

From 7th symposium on physics of ionized gases; Rovinj, Yugoslavia (16 Sep 1974).

In seventh Yugoslav symposium on physics of ionized gases.

A theoretical study is made of the sharing of energy among the constituents of a polyatomic, homogeneous, infinite medium under heavy ion bombardment. Examples are given of displacement efficiency and slowing-down densities in U-O for uranium and oxygen as a function of concentration. (2 figs.) (GHT)

7869 (NIRS-R-2, pp 4-6) DEPTH DOSE DISTRIBUTION OF GAMMA-RAYS IN MIXED N-GAMMA FIELD. Kawashima, K.; Hiraoka, T.; Shiragai, A.; Matsuzawa, H. Nov 1973. (In Japanese).

In first report on the cancer therapy with high energy particles and the utilization of short lived radionuclides in diagnostics. (National Inst. of Radiological Sciences, Chiba (Japan)).

In the ^{9}Be (d,n) ^{10}B reaction to produce fast neutrons for medical application and others, γ ray is inevitably generated, and in case of a human-body phantom, γ ray also occurs due to the neutron capture in hydrogen nuclei. Therefore it is necessary to estimate the gamma dosage in mixed n-γ field. From this viewpoint, the percentage depth dose of gamma ray in water phantom was measured with regard of fast neutrons, and also the percentage depth dose of thermal neutrons was measured. For the purpose, ionization chamber, TLD element, and film were used. With the ionization chamber as a reference dosimeter, the ratio of gamma and neutron components in air was about 7%. Within the water phantom, owing to captured γ ray, the ratio increases to about 13%. At the depth about 12.5 cm, both components are at the same order, and beyond it the gamma component is higher. Both TLD element and film are found to be effective for the intended purpose. (JA)

7870 (NIRS-R-2, pp 12-14) TISSUE EQUIVALENT MATERIAL FOR NEUTRONS. Hiraoka, T.; Kawashima, K.; Matsuzawa, H. Nov 1973. (In Japanese).

In first report on the cancer therapy with high energy particles and the utilization of short lived radionuclides in diagnostics. (National Inst. of Radiological Sciences, Chiba (Japan)).

It is necessary to make tissue equivalent materials for the measurement of radiation dose and internal dose distribution. The material for neutron irradiation was made for trial, and is reported. The absorption of energy by tissues is caused mostly through the reaction H(n,n')H, but other reactions such as H(n,γ)D and N(n,p)C are also important. The material was made to simulate the composition of elements in tissues, and special attention was paid for the composition of H and N. The composition of H and N were taken as 10.1% and 3.5% by weight, respectively. The mixture of polyethylene and nylon was used. Various kinds of nylon, polyethylene and polypropylene were tested, and the accepted composition was 33.0% of nylon X-1874 and 46.0% of polyethylene UF-4. 0.5% of AC-polyethylene was added, and 17% of carbon and 3.5% of calcium fluoride were included. A curve for the mass-energy conversion factor of photon energy obtained for the present material was in agreement with that of soft tissue. The values of KERMA of the present material for neutron energy were a little larger than that of soft tissue. However, the difference was not so large. The present material was considered to be good tissue equivalent material. (JA)

7871 (NUS-217) CALCULATIONAL MODELS FOR BETA DOSE FROM SPHERICAL PARTICLES. Anno, G. H. (NUS Corp., Washington, D. C. (USA)). 26 Feb 1965. 82p. Dep. NTIS $7.25.

A means of calculating the beta ray dose in tissue from a mixed radionuclide source particle of arbitrary size is considered for possible inclusion in the ROVER Flight Safety evaluation or NURSE programs. For the present case, the source particle is a high-Z material (Z $\simeq$ 84) and contains a mixed beta ray spectrum, while dose distribution in tissue, a low-Z material (Z $\simeq$ 7), is desired; a situation for which appropriate data is lacking. An investigation of the presently available techniques and data was carried out in order to (1) prescribe a method of computing the beta dose from a fuel particle for present use and also to (2) determine alternate methods to accomplish this task more accurately, perhaps by more detailed methods, if necessary in the future. (auth)

7872 (NUS-229(Rev.)) DOSE CALCULATION MODELS FOR REENTERING NUCLEAR ROCKET DEBRIS. DeAgazio, A. W. (NUS Corp., Washington, D. C. (USA)). Oct 1965. 49p. Dep. NTIS $5.50.

External dose functions and external and internal dose probability functions are derived, and external whole body gamma and beta dose relationships are derived for receptors who are mobile. The probability of receiving a given external dose; the number of people receiving at least a given dose and the overall population dose are also derived for external gamma radiation exposures. Functions for determining the probability of a receptor being struck by a particle that sticks to the skin and the number of people so affected are derived to allow estimation of the hazard from localized beta doses to the skin. Internal dose probability functions are derived for both ingestion and inhalation. (GHT)

7873 (SC-RR-69-855) BUCKL: A PROGRAM FOR RAPID CALCULATION OF X-RAY DEPOSITION. Cole, R. K. Jr. (Sandia Labs., Albuquerque, N. Mex. (USA)). Jul 1970. 69p. Dep. NTIS $6.50.

A computer program is described which has the fast execution time of exponential codes but also evaluates the effects of fluorescence and scattering. The program makes use of diffusion calculations with a buckling correction included to approximate the effects of finite transverse geometry. Theory and derivations necessary for the BUCKL code are presented, and the code results are compared with those of earlier codes for a variety of problems. Inputs and outputs of the program are described, and a FORTRAN listing is provided. Shortcomings of the program are discussed and suggestions are provided for possible future improvement. (GHT)

7874 (SC-RR-70-187) WONDY/BUCKL. Cole, R. K. Jr.; Dahlgren, D. A. (Sandia Labs., Albuquerque, N. Mex. (USA)). Jun 1970. 77p. Dep. NTIS $7.00.

The BUCKL deposition code is briefly described. Reasons for its use are illustrated by examples, and the incorporation of the code as a deposition subroutine in the WONDY code is also described.(auth)

7875 (SC-RR-710713) IMPROVEMENTS IN THE CHART D RADIATION-HYDRODYNAMIC CODE II: A REVISED PROGRAM. Thompson, S. L.; Lauson, H. S. (Sandia Labs., Albu-

querque, N. Mex. (USA)). Mar 1974. Contract AT(29-1)-789. 299p. Dep. NTIS $18.00.

CHART D is a very flexible code for computing coupled hydrodynamic motion and radiation diffusion. The finite difference analogs of the Lagrangian equations of motion with energy transport terms are solved in one-dimensional rectangular, cylindrical, or spherical coordinates. Elastic–plastic, porous, and high-explosive materials are treated. Thermal and electron conduction, spall, and rejoin calculations are provided. Realistic equations of state and means for coupling to externally generated energy deposition profiles are included. Complete input instructions and details of code models and structure are given. (auth)

7876 (UCSD-34P220X1) ROLE OF SECONDARY PARTICLES IN THE IONIZATION PROCESS. Progress Report, April 1—December 31, 1974. Baily, N. A. (California Univ., San Diego, La Jolla (USA). Dept. of Radiology). [nd]. Contract AT(04-3)-34. 25p. Dep. NTIS $4.25.

Development of a multiwire gas flow proportional counter is described. Preliminary data, taken using a thin ^{241}Am source, are shown. Information about a newly developed preamplifier is presented and its performance compared with an existing commercial model. The data handling system, utilizing a multichannel analyzer, solid state switching line, and computer, is described. (GHT)

7877 TABLES OF ENERGY LOSSES AND RANGES OF LOW ENERGY ELECTRONS AND POSITRONS. Sugiyama, H. (Electrotechnical Lab., Tanashi, Tokyo (Japan). Tanashi Branch). Denshi Gijutsu Sogo Kenkyusho Iho; 38: No. 6-7, 351-362(Aug 1974). (In Japanese).

An approximate semiempirical formula of stopping power has been derived on the basis of Bethe's formula. Three basic correction terms are introduced in the present work: (a) electron exchange effect, (b) the effective number of electrons in a target atom, and (c) energy dependence of the mean excitation energy. The parameters are determined from experimental proton data and the low energy stopping power estimated by Peterson and Green for nitrogen molecules. Graphs and tables of stopping powers and ranges are given for typical solids, gases and mixtures for the energy range from 30 eV to 10 keV. (auth)

7878 LEAD TRANSMISSION CURVE FOR 31-GeV ELECTRONS. Belousov, A. S.; Malinovskii, E. I.; Rusakov, S. V.; Kruglov, S. P.; Savel'ev, V. D. Sov. At. Energy (Engl. Transl.); 37: No. 1, 754-755(Jul 1974).

Translated from At. Energ.; 37: No. 1, 71-72(Jul 1974).

Measurement of the radial distribution of absorbed energy was made with LiF thermoluminescent detectors placed within a lead absorber. Radial distribution of absorbed energy and transmission curves are shown. Isoenergy curves are also shown. (GHT)

7879 I. STOPPING CROSS SECTION ADDITIVITY FOR 0-2 MeV ^4He IONS IN SOLIDS. II. MAGNETITE THIN FILMS: FABRICATION AND ELECTRICAL PROPERTIES. Feng, J. S. Y. Pasadena, CA; California Inst. of Tech. (1975). 263p. University Microfilms Order No. 75-9524.

Thesis (Ph. D.).

Two new methods are described for testing Bragg's rule that energy loss in a compound is a linear superposition of the atomic stopping powers. The apparent sensitivity limit of the methods is below 1 percent. The first test is the extension of the rule to alloys and non-stoichiometric compounds, applied to layered structures of Au--Ag, Au--Cu, Au--Al, and their alloys or compounds. The total energy loss before and after the two layers were mixed was reproducible within 1 percent. The second test involves oxides of Si, Al, Mg, and Fe. A unique contribution by oxygen to the molecular stopping cross sections is shown, and is apparently 6-22 percent lower than the value expected from the measured cross section for molecular O_2 in the gas phase. A low temperature process for manufacturing magnetite (Fe_3O_4) thin films by converting hematite (alpha--Fe_2O_3) thin films is described. The films produced are unambiguously identified as magnetite. Resistivity, dc Hall effect, and transverse magnetoresistance measurements are described. (GHT)

7880 ENERGY DEPOSITION BY HEAVY IONS IN A TISSUE EQUIVALENT GAS. Varma, M. N.; Baum, J. W.; Kuehner, A. V. (Brookhaven National Lab., Upton, N.Y.). Radiat. Res.; 62: No. 1, 1-11(Apr 1975).

Energy deposited by heavy ions as they pass through gaseous media was measured as a function of radial distance from their tracks. The experimental values are compared to Paretzke's (1) theoretically calculated values. The experimentally values show very good agreement with theory out to distances which approximate the range of the secondary electrons. Beyond these distances more energy was deposited than was predicted. The discrepancy is ascribed to contributions to energy deposition due to (a) scattering of gas atoms and primary ions, and (b) emission of high-energy Auger electrons from the incident heavy ions. (auth)

7881 POLE IZLUCHENIYA TOCHECHNOGO MONONAPRAVLENNOGO ISTOCHNIKA GAMMA-KVANTOV. (Radiation Field of a Point, Single-Direction, Gamma Source). Zolotukhin, V. G.; Kilem, L. R.; Ksenofontov, A. I.; Lipunskii, O. I.; Panchenko, A. M. Moscow; Atomizdat (1974). 160p. (In Russian).

Detailed information is given on the differential and integral characteristics of the scattered radiation field from a point, mono-directed, monoenergetic gamma source. Data were obtained for a wide selection of shielding materials and initial energies, and by means of the data it is possible by means of transformations to calculate the required characteristics of the field for sources of arbitrary form and for angular radiation distributions. A new modification of the Monte Carlo method is presented by means of which it is possible to calculate various characteristics of the field at large depths of passage of the radiation. A description and text of a working program in Algol are presented. (SJR)

7882 PROJECTED RANGE STATISTICS. Semiconductors and Related Materials. 2nd Edition. Gibbons, J. F.; Johnson, W. S.; Mylroie, S. W. Stroudsburg, PA; Dowden, Hutchinson and Ross, Inc. (1975). vp. Halsted Press, New York.

A collection of range statistics computed from basic principles set out by Lindhard and Scharff and subsequently elaborated upon by several authors is presented. Its purpose is to supply useful data on ion penetration to workers in the semiconductor industry who are concerned with the application of ion implantation to semiconductor doping. The book is divided into two parts. The first part explains what has been done and describes the nature of the presentation. The second part contains the range statistics. Chapter 1 defines the problem and discusses the choice of ion-substrate combinations made. Chapter 2 presents the equations used, and Chapter 3 discusses the computational strategy. The final chapter discusses what data are available and how to locate and use them. (auth)

7883 DYNAMICS OF A CLASSICAL ELECTRON IN A DENSE MEDIUM OF DISORDERED SCATTERERS. Lagar'kov, A. N.; Sarychev, A. K. Zh. Eksp. Teor. Fiz.; 68: No. 2, 641–648(Feb 1975). (In Russian).

The motion of a classical electron in a dense medium of disordered scatterers is studied. Interaction between an electron and a scatterer is described by a potential with an attractive polarization part and a repulsive short-range part. The autocorrelation functions of the electron velocity are found by the computer experiment technique for various values of the electron energy and scatterer density. The electron conductivity is calculated as a function of energy. A sharp increase of electron conductivity is observed in a narrow energy band corresponding to opening of the flow channels. (auth)

7884 IONOMETRIC METHOD IN DOSIMETRY. Rebigan, F. (Inst. of Atomic Physics, Bucharest). Stud. Cercet. Fiz.; 26: No. 6, 663–679(1974). (In Rumanian).

The radiation quantities and units as they have been stated in the last ICRU Reports are reviewed as well as some detailed explanation. An attempt is made to define the concepts of released energy, absorbed energy, and linear energy transfer (LET). A simple and original treatment of the electronic equilibrium is given in view of applying it to the absolute measurement of radiation dose by ionometric method. (auth)

7885 RELATION BETWEEN THE CURVE OF THE GROWTH OF IONIZATION AND THE CONDITIONS OF FORMATION OF A γ RADIATION BEAM. Stavitskii, R. V.; Kheteev, M. V. Med. Radiol.; 19: No. 11, 53–59(Nov 1974). (In Russian).

During the passage of γ radiation through the boundary between two media with different atomic number there is a transition zone in which the depth of the region of ionization growth increases with increasing energy of the incident γ radiation. The curve of the ionization growth was experimentally measured for γ radiation up to 1 MeV. The results showed that with placement of the γ sources in the free air the ionization growth curve cannot be obtained because of the contribution of low-energy scattered γ radiation and electrons. With decrease of the aperture of the γ beam a growth ionization curve starts to appear with aperture angle ~50°. Further reduction of the angle leads to a very clear appearance of the ionization growth curve. An uncollimated source cannot be used because of the presence of low-energy scattered radiation in the beam. It was concluded that formulas for the calculation of the exposure dose rate based only on the activity of the source cannot be used. In the use of γ sources in contact therapy in biological experiments it is necessary to have data on the spectral composition of the radiation scattered in the source itself and its surrounding construction materials. (JSR)

7886 PHYSICAL MEASUREMENTS AND CLINICAL OBSERVATIONS ON THE BACKSCATTER OF 10 MeV ELECTRONS FROM LEAD SHIELDING. Weatherburn, H.; McMillan, K. T. P.; Stedeford, B.; Durrant, K. R. (Churchill Hosptial, Oxford). Brit. J. Radiol.; 48: No. 567, 229–230(Mar 1975).

Radiotherapy of a large moderately differentiated squamous-cell carcinoma of the lower right lip, using 10-MeV electrons and a 3.5 mm thick lead shield produced unexpectedly severe mucosal and epidermal reactions before the prescribed dose (4,400 rads in 11 sessions, 3 times per week) had been fully administered. A measurement of the backscatter from the lead shielding during treatment gave a value considerably in excess of the expected one, and sufficiently high to explain the severity of the reaction. Subsequent measurements using tissue equivalent material in front of the lead shielding and extruded lithium fluoride (TLD 100) chips showed that the backscatter of a 10-MeV electron beam from 3.5 mm of lead at a level of 80 per cent isodose was between 40 and 50 per cent of the maximum dose. The backscatter fell with increasing distance from the lead, but at no point did the total dose fall below 95 per cent of the maximum value on the central axis dose curve. The patient would therefore have received a dose of approximately 6,900 rads to the posterior aspect of his lip, instead of the prescribed 4,400 rads. The dependence of backscatter on atomic number of the backscattering material and electron energy is discussed, and a coating of wax in front of the shielding recommended to reduce the effect. (UK)

7887 SIGNIFICANT ELECTRON BEAM PARAMETERS AND DOSIMETRY FOR RADIATION PROCESSING APPLICATIONS. Relevant Sources of Information. Martin, J. A. (Moleculon Research Corp., Cambridge, MA). Int. J. Radiat. Eng.; 1: No. 2, 195–212(Aug 1971).

Electron interactions with matter of significance to radiation processes are discussed in simplified terms. Electron range, dose rate, material thickness effects, and temperature effects are treated. Sources of information on dosimetry and radiation effects are also presented. (auth)

7888 BENCHMARK DATA FOR THE PENETRATION OF 6 MeV GAMMA PHOTONS THROUGH WATER. Smitton, C. (Central Electricity Generating Board, Manchester, Eng.); Bishop, G. B. J. Brit. Nucl. Energy Soc.; 14: No. 1, 89–94(Jan 1975).

Benchmark data is presented for scalar flux penetration of 6.13-MeV γ photons through distances up to 1.2 m of water. Experimental and calculated data have been established and are in good agreement. The emerging spectrum at any penetration has been shown to be almost entirely controlled by Compton scattering and is approximately invariant between 1.1 and 3.6 mean free path penetrations. (auth)

7889 APPROXIMATE CALCULATION OF EXPOSURE DOSE RATES OF FISSION PRODUCT MIXTURES. Zappe, D.; Schuricht, V. (Technische Universitaet, Dresden). Isotopenpraxis; 11: No. 2, 53–55(Feb 1975). (In German).

Owing to inaccurate nuclide data and fission yield values, calculations of exposure dose rates of fission product mixture yield considerable differences in the obtained results. The mean range of variation being about 50 percent, exposure dose rate during the first 30 d follows the $t^{-1.2}$-law. Therefore, it seems to be justified to reduce the number of nuclides used for the calculation of exposure dose rates. With deviation of 10, 20, or 50 percent from the values obtained with all nuclides taken into consideration, the number of nuclides is diminished to amount to 44, 31, or 15 respectively. (auth)

7890 SURFACE ROUGHNESS EFFECTS ON ENERGY LOSSES OF FAST ELECTRONS CROSSING METALLIC SAMPLES. Nourtier, A. (Paris-11 Univ., 91- Orsay (France). Lab. de Physique des Solides). Ann. Phys. (Paris); 8: No. 6, 443–459(Dec 1974).

The unevenness of the surface of a metallic sample affects the surface plasmon spectrum and thence the energy losses of fast charged particles crossing the sample. A theory of this effect is presented in which the metal is characterized by a simple local dielectric constant and the interaction with the probe particle is treated semiclassically. By a classical Green's function method, a closed expression is obtained for the loss spectral profile as a function of the momentum transfer, without assumption on the roughness shape. The geometry of a rough surface is then considered in detail. The loss spectral profile is calculated for some examples of weak periodic corrugations. For a general weak roughness, the width and the mean shift of the loss profile are given in terms of the roughness correlation function. Finally, the case of strong roughness is examined for small and large values of the momentum transfer. (FR)

7891 BREMSSTRAHLUNG ROM ^{32}P BETAS. Prasada Babu, R.; Narasimha Murty, V. A.; Narasimha Murty, K. (Andhra Univ., Waltair, India). pp 204 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

7892 RANGE OF ^{65}Zn IONS OF KILOELECTRON VOLT ENERGY IN ALUMINUM. Misra, N. K.; Venkatasubramanian, V. S. (Indian Inst. of Science, Bangalore). pp 261–263 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

7893 ANALYTICAL APPROACH FOR DEPTH DOSE CALCULATIONS (^{60}Co BEAMS WITH FIXED SOURCE-TARGET DISTANCE). Kanellitsas, C.; Fayos, J. V. (Univ. of Michigan, Ann Arbor). Radiology; 115: No. 1, 181–185(Apr 1975).

A method is described to calculate depth dose distribution to a principal plane using analytical formulas for ^{60}Co teletherapy units and constant source-to-target distance. The formulas were derived from experimental measurements taking into consideration the obliquity of the beam. For the purposes of dose calculation the beam was divided into primary and scattered components. A computer program incorporating the formulas was developed for an IBM 360/67 computer. Dose distributions computed and obtained from experimental measurements were in good agreement. The computer program is now in use for treatment planning, including rotational techniques. (auth)

7894 STOPPING POWERS OF SOME LOW ATOMIC NUMBER MATERIALS FOR ALPHA PARTICLES OF ENERGIES UP TO 6 MeV. Venkataraman, G.; Murthy, M. S. S.; Viswakarma, R. R. (Bhabha Atomic Research Centre, Bombay). Health Phys.; 28: No. 4, 461–464(Apr 1975).

Stopping powers of low atomic number materials for α particles are of great interest in radiation dosimetry and protection. This note points out the considerable discrepancy existing in published α stopping power data and gives revised computed values of stopping powers for tissue, water, mylar and cellulose nitrate for α particles of energies up to 6 MeV. The revised values were obtained by making use of measured elemental atomic stopping powers and assuming the Bragg additivity rule. (UK)

7895 NOTE ON "ISOTROPIC INCIDENT FLUX IN MONTE CARLO CALCULATIONS". Nambi, K. S. V. (Bhabha Atomic Research Centre, Bombay). Health Phys.; 28: No. 4, 481–482 (Apr 1975).

In a letter entitled "Isotropic Incident Flux in Monte Carlo Calculations" (Health Phys.; 24: (1973)), R. H. Ritchie demonstrates the necessity of weighting the incident particles by the factor cos θ where θ is the angle between the inward normal to the surface at the point of entry and the direction of incidence. The physical meaning of this statement is that the number of particles crossing a surface element in a given direction is proportional to the area of its projection on a plane perpendicular to this direction. The mathematical formulation of the problem by Ritchie is restricted to first interactions of the particle. The alternative calculation which is given here shows that this restriction is necessary, and thus that the factor cos θ obtained by Ritchie has in general not the right physical meaning. (UK)

Radiation Source Calibration and Standardization

Refer also to abstract 6521.

7896 MEASUREMENT OF CERTAIN CHARACTERISTICS OF ^{249}Bk. Glazov, V. M.; Borisova, R. I.; Shafiev, A. I. Sov. At. Energy (Engl. Transl.); 37: No. 1, 764–765(Jul 1974).

Translated from At. Energ.; 37: No. 1, 78–79(Jul 1974).

The maximum energy of β particles from ^{249}Bk was measured by the method of absorption and on the basis of the Curie graph. The half-life of the isotope was measured by a radiometric method over a period of one year. Results are given. (GHT)

7897 CONTRIBUTION TO HEURISTICAL ANALYSIS OF EXPERIMENTAL DECAY CURVES. Kindler, E. (Charles Univ., Prague). Isotopenpraxis; 11: No. 2, 56–57(Feb 1975).

A description of a computer program for the analysis of decay curves is presented in the international algorithmic language ALGOL 60. As it needs only a small subset of its facilities, it is possible to implement the algorithm without obstacles in any laboratory with a computer. The algorithm needs efficiently less computer time than other methods, based on classical mathematical considerations. (auth)

7898 DESIGN AND USE OF PRIMARY CALIBRATION STANDARDS IN PHOTON DOSIMETRY. Guiho, J. P.; Le Gallic, Y. (Cea Centre d'Etudes Nucleaires de Saclay, 91- Gif-sur-Yvette (France). Lab. de Metrologie des Rayonnements Ionisants). Bull. Inf. Bur. Natl. Metrol.; 5: No. 17, 15–22(Jul 1974). (In French).

It is absolutely necessary to establish for dosimetry purposes a coherent reference system which allows: connection of national and international intercomparisons, standardization of secondary references, survey and comparisons of different methods of measurement. For photon dosimetry, rather than choosing detectors as standards, the Bureau National de Metrologie has adopted the γ beams themselves as primary references. Three beams with energies covering the range of practical interest have been defined, each one being characterized by the dosimetric quantities used in the description of ionizing radiation field: energy flux density, exposure and absorbed dose in a reference medium; such a system allows the establishment of the relations between the different ways of describing a same physical phenomena. Precisions of the beams definitions with exposure and absorbed dose lie between 1.1 and 1.7%. (FR)

Shielding Calculations and Experiments

Refer also to abstracts 7273, 7677, and 8352.

7899 (EUR-5212e) MORSE-E: A NEW VERSION OF THE MORSE CODE, ESIS. Ponti, C.; Van Heusden, R. (Commission of the European Communities, Ispra (Italy). Joint Nuclear Research Center). 1974. 15p. Dep. NTIS (US Sales Only) $4.00. EUR B. Fr. 40.-.

A version of the MORSE code which has been written to facilitate the practical use of this program is described. MORSE-E is a ready-to-use version that does not require particular programming efforts to adapt the code to the problem to be solved. It treats source volumes of different geometrical shapes. MORSE-E calculates the flux of particles as the sum of the paths travelled within a given volume; the corresponding relative errors are also provided. (auth)

7900 (JUL-1133-PC) SIMPLE METHOD FOR THE CALCULATION OF MULTILAYERED SHIELDS FOR γ SOURCES. Sauermann, P. F. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Physikalische Chemie). Nov 1974. 41p. (In German). Dep. NTIS (US Sales Only) $5.25.

Behind thick γ-shields of concrete or other shielding materials which have low to moderate density, the scattered radiation exceeds the unscattered radiation by factor (B-1). If required, therefore, additional shielding measures should concentrate on the attenuation of this low energy radiation. The energy distribution of the scattered radiation may be characterized by an effective energy. This has been done in this paper for some common shielding materials. Furthermore, a simple method is given for the calculation of multi-layer shields based on the effective energy concept. Some examples are given which illustrate the application of the method. (auth)

7901 (NTO-I-0282) NTO PROCEDURE FOR PHASE V SHIELDING INTEGRITY (SIC) TESTS AT E-MAD FACILITY. Final Issue. (NERVA Test Operations, Jackass Flats, Nev. (USA)). 7 Sep 1967. 69p. Dep. NTIS $6.50.

The descriptive material and detailed procedures to be used in conjunction with Report No. NTO-I-0015 (Revision C), Procedure No. NTO-I-0033, Procedure No. NTO-I-0026 and Procedure No. NTO-I-0024 (NTP Procedure reports for Phase I, II, III and IV, respectively, Shielding Integrity Check (SIC) Tests for the E-MAD Facility) as required for the performance of the Phase V portion of the Shielding Integrity Check (SIC) Tests at the E-MAD Building are given. This phase of the test will be performed by NERVA Test Operations under Contract SNP-1. The shielding surfaces will be tested for shielding integrity so that corrections of violations can be effected and/or procedures can be adapted to insure personnel safety. (auth)

7902 (TID/SNA-361) DEVELOPMENT OF AN INTEGRATED SYSTEM OF NEUTRON-INDUCED-ACTIVATION AND SHIELDING COMPUTER CODES FOR COMPLEX ENGINEERING STRUCTURES. Folder 2. Business Management. (Aerojet-General Corp., Sacramento, Calif. (USA)). 23 Oct 1969. 43p. Dep. NTIS $5.25.

A proposal is made to develop computer codes to compute photon dose rates generated in complicated engineering structures as a result of neutron-induced activation. The proposed system would treat neutron transport, neutron-induced activation, and subsequent photon transport to desired detector locations. Business management information related to the proposal is included. (GHT)

PHYSICS (THEORETICAL)

General

Refer also to abstract 7947.

7903 (CONF-7306115-P1, pp B.IV1–B.IV19) GENERAL REVIEW OF STATISTICAL MECHANICS. Hansen, J. P. (Laboratoire de Physique Theorique et Hautes Energies, Orsay, France). 1973.

From 3rd international colloquium on advanced computing methods in theoretical physics; Marseille, France (25 Jun 1973).

In third international colloquium on advanced computing methods in theoretical physics, Marseille, June 25–29, 1973. (Centre National de la Recherche Scientifique, 13- Marseille (France). Centre de Physique Theorique).

A review is given of selected topics in computer simulations of many-body systems, covering some important work done over the last 2 years. This includes computations of depolarized scattered light spectra from simple fluids, equilibrium and nonequilibrium simulations of transport phenomena leading to the determination of transport coefficients, the study of fluids of diatomic homonuclear molecules and the computation of the equilibrium properties and phase transitions of dense ionized matter. (auth)

7904 (CONF-7306115-P1, pp C.IV1–C.IV18) COMPUTER GENERATION OF INTEGRANDS FOR FEYNMAN PARAMETRIC INTEGRALS. Cvitanovic, P. (Cornell Univ., Ithaca, NY). 1973.

From 3rd international colloquium on advanced computing methods in theoretical physics; Marseille, France (25 Jun 1973).

In third international colloquium on advanced computing methods in theoretical physics, Marseille, June 25–29, 1973. (Centre National de la Recherche Scientifique, 13- Marseille (France). Centre de Physique Theorique).

TECO text editing language, available on PDP-10 computers, is used for the generation and simplification of Feynman integrals. This example shows that TECO can be a useful computational tool in complicated calculations where similar algebraic structures recur many times. (auth)

7905 (COO-3071-139) MATRIX MECHANICS AS A PRACTICAL TOOL IN QUANTUM THEORY: THE ANHARMONIC OSCILLATOR. Li, C. T.; Klein, A.; Krejs, F. (Pennsylvania Univ., Philadelphia (USA). Dept. of Physics). 18 Mar 1975. 41p. Dep. NTIS $5.25.

For an anharmonic oscillator, it follows from the nodal structure of the exact wave functions as functions of the quantum number n that the matrix elements [n parallel x parallel n'] and [n parallel p parallel n'] should be rapidly decreasing functions of parallel n-n' parallel. Matrix elements of polynomials in x and p should therefore be well approximated by a finite number of terms in their sum role decomposition. From the matrix elements of the equations of motion for x and for p and of the commutator [x,p], one thereby obtains closed sets of nonlinear algebraic equations to characterize subespaces of the Hilbert space of exact eigenfunctions. The approximations are also derived from a novel variational principle, and numerous variant approximation schemes are suggested. Essentially exact numerical results are obtained and compared with previous work. The broad applicability of the techniques is emphasized. (auth)

7906 (HMI-B-151) EXTRAPOLATION METHODS AND APPLICATIONS. Schmidt, R. (Hahn-Meitner-Institut fuer Kernforschung Berlin G.m.b.H. (F. R. Germany). Bereich Datenverarbeitung und Elektronik). Aug 1974. 312p. (In German). INIS.

General extrapolation algorithms are derived on the basis of a recursive solution of linear equation systems. The extrapolation algorithms are applied to improve approximate solutions when an asymptotic expansion of the approximation error is known compared with the exact solution. A demonstration is given of how to obtain improved approximation from the approximation of the step width series in the case of more than one element of the asymptotic error expansion being known. (GE)

7907 (ITF-74-149P) SEPARATION OF REFERENCE SYSTEM IN A COLLECTIVE VARIABLE METHOD. Yukhnovskii, I. R. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1974. 36p. (In Russian). Dep. NTIS (US Sales Only) $5.00.

A new method in the theory of virial expansion for the systems containing long-range interactions is proposed. The partition function and the distribution functions of the reference system with short-range interactions between the particles is supposed to be known. On this basis the well known technique of the method of collective vaviables is generalized and the cumulants $M_n(\overline{K}_1, \ldots, \overline{K}_n)$ are inserted. The general expression for $M_n(\overline{K}_1, \ldots, \overline{K}_n)$ through the correlation functions is made. The fundamental theorem on the reduction of some definite terms of the cumulant $M_n(\overline{K}_1, \ldots, \overline{K}_n)$ whose arguments $\overline{K}_m, \ldots, \overline{K}_n$ form reducible sum is proved. The group-integral expansion for the free energy is built in a usual way like a virial expansion for the system with pure coulomb interaction, but the screened potential is renormalized, the vertices are compound and each group of the field-vertices is connected by the suitable distribution function of the reference system. (auth)

7908 (ITF-75-7P) GROUND STATE OF MANY BOSON MODEL SYSTEMS. I. One-Dimensional Bose-gas with Delta-Repulsion Interaction. Vakarchuk, I. A. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1975. 15p. (In Russian). Dep. NTIS (US Sales Only). $4.00.

A ground state of one-dimensional Bose-gas with δ-repulsion obtained by means of the pair distribution function in the previous work is investigated. An effective potential and the ground state energy are calculated. The expression, obtained for the energy per one particle $\epsilon(\gamma) = (\pi^2/2)\{1 - [1 + (2/\pi)\sqrt{\gamma}]e^{-(2/\pi)\sqrt{\gamma}}\}$ is exact in the limit of weak coupling $\gamma \to 0$ and is qualitatively true in the case of $\gamma \to \infty$. (auth)

7909 (ITP-74-120P) LIMITING PROBLEM FOR THE THREE PARTICLE SYSTEM. Filippov, G. F.; Vasilevskii, V. S. (AN Ukrainskoj SSR. Kiev. Inst. Teoreticheskoj Fiziki). 1974. 19p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The asymptotic solutions of the Schrodinger equation for the system of three identical fermions interacting by means of the two-particle oscillator exchange potential are constructed. The asymptotic solutions are limiting for the exact solution at large values of the quantum number ν which defines the permuting symmetry of the spacial part of the wave function. The simplifications appear due to the fact that when $\nu \gg 1$ the adiabatic approximation turns to be valid and in the system it is possible to separate the internal motion with the energy proportional to ν from the small vibrations whose energy is independent from ν, and the rotation whose energy is proportional to $1/\nu$. (auth)

7910 (ITP-74-122E) CAUCHY PROBLEM FOR THE KINETIC BOGOLIUBOV EQUATIONS. The BCS Model. Vidybida, O. K. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1974. 20p. Dep. NTIS (US Sales Only) $4.00.

The set of the kinetic Bogoliubov equations for the infinite quantum system of particles distributed in the space with the average density $1/\nu$ and interacting with the Bardeen-Cooper-Shrieffer model operator is considered as an abstract equation in a certain countably-normed space b^{ν} of the sequences of integral operators. In this case a unique solution of the Cauchy problem for arbitrary initial values from b^{ν} is obtained, stationary solutions and a class of initial values approaching stationary solutions in the process of evolution are constructed. (auth)

7911 (JINR-E2-8646) CANONICAL REALIZATIONS OF THE LIE ALGEBRAS gl(n,R) AND sl(n,R). I. Formulae and Classification. Havlicek, M.; Lassner, W. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 17p. Dep. NTIS (US Sales Only) $4.00.

The generators of the Lie algebra of the general linear group gl(n,R) and of the special linear group sl(n,R) are, recurrently, expressed through polynomials in the quantum canonical variables p_i and q_i. These realizations are skew-hermitean, the Casimir operators are realized by constant multiples of identity element and, in dependence of the number of the canonical pairs used, they depend on k(k – 1 for sl(n,R)), k = 2, . . . , n free real parameters. (auth)

7912 (JINR-P4-8710) TWO-CENTER PROBLEM IN QUANTUM MECHANICS. VI. The Wave Functions of the Continuum. Ponomarev, L. I.; Somov, L. N. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 25p. (In Russian). Dep. NTIS (US Sales Only) $4.25.

An algorithm is given for the calculation of the wave functions (to within $\sim 10^{-7}$) and the separation constants λ_{mq} (k,R) (to within $\sim 10^{-11}$) of the continuum of the two-center problem with Coulomb interaction. The phases Δ_{mq} (k,R) of the solutions to the radial equation are found as functions of the momentum k and the intercenter spacing R. The constructed angular Σ_{mq} (η; k,R) and radial Π_{mq} (ξ; k,R) Coulomb spheroidal functions are a modular generalization of the Coulomb functions F_l (y,kr) of the one-center problem. (auth)

7913 RELATIVITY AND QUANTIZATION. VII. Spatial-Temporal, Discrete-Continual (Quantum-Mechanical) Model of

a Particle. Anastassov, A. H. (Univ. of Sofia). Nuovo Cim., 26B: No. 2, 326-334(11 Apr 1975).

From a logical standpoint quantum physics is baseless: it lacks a mathematical model of the material-system concept. The statement is motivated from the idea that the definition of this concept, valid in the continuous theory of space-time and matter (the theory of relativity), properly modified and completed, can constitute a basis for quantum mechanics. The basic ideas are: the action of matter is 4-discrete, space–time has hidden states which are not directly reflected on the metric, Ψ has the objective-real meaning of a characteristic of these states, quantum physics operates with hidden parameters of nonclassical type. (auth)

7914 ESTIMATION OF A DISPLACEMENT PARAMETER OF A QUANTUM SYSTEM. Helstrom, C. W. (Paris Univ., Orsay, France). Int. J. Theor. Phys.; 11: No. 6, 357-378(Dec 1974).

A displacement parameter such as the angle of rotation or the position of a quantum system, or the phase of a harmonic oscillation, is to be estimated by observing the system with an apparatus that applies to it an operator-valued measured (o.v.m.). The o.v.m. minimizing the average cost of errors in the estimate is determined by quantum estimation theory for a system in a pure state. The best estimate of the parameter is found to be the more accurate, the greater the uncertainty of the dynamical variable serving as the infinitesimal generator of the displacement group. The relation of this result to such uncertainty principles as those between angle and angular momentum, and between oscillator phase and photon number, is discussed. A lower bound to the variance of an unbiased estimate of the time of occurrence of an event in the evolution of a system is derived from the quantum-mechanical Cramer-Rao inequality. It is inversely proportional to the square of the uncertainty of the energy of the system. (auth)

7915 MINIMAL-DISTURBANCE MEASUREMENT AS A SPECIFICATION IN VON NEUMANN'S QUANTAL THEORY OF MEASUREMENT. Herbut, F. (Institut Za Nuklearne Nauke Boris Kidric, Belgrade). Int. J. Theor. Phys.; 11: No. 3, 193-204(Nov 1974).

In von Neumann's theory (Mathematical Foundation of Quantum Mechanics., Princetown Univ. Press, 1955)) an incomplete observable A is measured by measuring any complete observable B whose function A is. This procedure is narrowed down by the additional requirement of preservation of the sharp value of any observable compatible with A. The requirement is shown to be equivalent to the unique change of state: $\rho \rightarrow (\mathrm{tr}\,\rho P_n)^{-1} P_n \rho P_n$ (P_n is the eigenprojector of A corresponding to the obtained eigenvalue α_n, ρ is the statistical operator of the initial state, and by assumption $\mathrm{tr}\,\rho P_n > 0$). This characterizes the minimal-disturbance measurement. A necessary and sufficient condition is derived for the selection of the above observable B so that its measurement implies the minimal-disturbance measurement of A. For arbitrary ρ and A, there exists a B satisfying the condition. Hence, this constitutes a reasonable specification within von Neumann's theory, reducing the latter to the physically preferable minimal-disturbance measurement theory. (auth)

7916 PATH-INTEGRAL FORMULATION OF THE PAULI EQUATION USING TWO REAL SPIN COORDINATES. Bezak, V. (Electrotechnical Institute, Slovak Academy of Sciences, Bratislava). Int. J. Theor. Phys.; 11: No. 5, 321-339(Dec 1974).

Feynman's path-integral quantum-mechanical formulation is generalized for particles of spin ½. In the one-particle case, the path-integral formulation uses paths in a Euclidean real five-dimensional space, two coordinates (u,v) being reserved for spin. The path integral is proven to correspond exactly to the Pauli equation. A canonical density-matrix formulation is also dealt with. Basic ideas are to start with differential spin operators instead of the Pauli matrices and apply them to functions $\Psi = \psi_1(r,t)u + \psi_2(r,t)v$ where ψ_1,ψ_2 are the Pauli wave functions. Then a "nilpotent" spin "kinetic-energy" term is added to the Hamiltonian. This enables one to find a nonmatrix spin-dependent Lagrangian which is used as usual in the action of a path integral of the Feynman type. Integral relations are derived from which the path integral can be transformed into components of the Pauli matrix Green's function (propagator) or the canonical density matrix. As an example, a path-integral calculation of the normal Zeeman splitting is carried out. (auth)

7917 FUNCTIONAL PROPERTIES OF QUANTUM LOGICS. Maczynski, M. J. (Politechnika Warszawska, Poland). Int. J. Theor. Phys.; 11: No. 3, 149-156(Nov 1974).

A quantum logic is defined as a set L of functions from the set of all states S into [0,1] satisfying the orthogonality postulate: for any sequence $\alpha_1,\alpha_2,\ldots$ of members of L satisfying $\alpha_i + \alpha_j \leq 1$ for $i \neq j$ there is $b \in L$ such that $b + \alpha_1 + \alpha_2 + \ldots = 1$. Every logic L is in a natural way an orthomodular σ-orthocomplemented partially ordered set $(L,\leq,')$ with members of S inducing a full set of measures on L. It is shown that a logic L is quite full if and only if $(L,\leq,')$ is isomorphic to an orthocomplemented set lattice of subsets of S. Sufficient conditions are given in order that a quite full logic be representable in the set of projection quadratic forms f(u) = (Pu,u) on a complex Hilbert space, or in the set of trace functions f(A) = Trace (AP) generated by projections P, where the domain of f is the set of nonnegative self-adjoint trace operators of trace 1 in a complex Hilbert space. (auth)

7918 ROTATIONAL SOLUTIONS UNDER THE NEW THEORY OF MOTION. Allen, A. D. (Algorithms Inc., Northridge, CA). Int. J. Theor. Phys.; 11: No. 5, 317-319(Dec 1974).

A new theory of motion was recently introduced (Int. J. Theor. Phys.; 9: 219(1974)) which resolves several problems in the philosophy of physics and mathematics by replacing the continuum with nonvanishing time. Nonvanishing time means that the magnitude of an instant does not have the functional properties of zero, even though it may be very small. As a result, joint functions of time, such as s = vt, vary as the other terms even when time is instantaneous. Hence size (vdt or instantaneous position) is increasing as velocity. Some quantitative solutions are presented to the above for the case in which a point of mass m is revolving in a perfect circle with uniform speed $v = \omega r$. The magnitude of an instant dt—the minimum time for real events—is found by obtaining the magnitude of the arc ds along which the rotating point is distributed over dt time. Under the Heisenberg uncertainty principle this turns out to be $ds^2 = \hbar(m\omega)^{-1}$. If the de Broglie equation and Einstein's two equations for photon energy are introduced, then in general $ds^2 = \lambda r$. Under the quantum mechanical definition of orbital angular momentum $\lambda r^{-1} = 2\pi m^{-1}$, where n is the integral scalar for $\hbar$. Hence there is an asymmetry on the right side of the last expression for ds, and the ratio of ds to the circumference of the circle is $(2\pi n)^{-\frac{1}{2}}$. (auth)

7919 PARASTATISTICS AND THE LIE ALGEBRAICAL METHODS USED THERE. Palev, T. (European Organization for Nuclear Research, Geneva). Int. J. Theor. Phys.; 10: No. 4, 229-237(Aug 1974).

Some of the properties of the parafield operators are reviewed, and where the difference between the ordinary and paraquantization originates is discussed in some detail. Particular attention is paid to the many-vacuum representations of the para-Fermi operators. (auth)

7920 WHAT WE HAVE LEARNED ABOUT REPRESENTING LOCAL NONRELATIVISTIC CURRENT ALGEBRAS. Goldin, G. A. (Univ. of Pennsylvania, Philadelphia). pp 101-114 of Local Currents and Their Applications. Sharp, D. H.; Wightman, A. S. (eds.). Amsterdam; North-Holland Publishing Company (1974).

The review of local relativistic current algebras is given in terms of a chart having a vertical axis which represents the nature of the Schwinger terms in the current algebra, c-number, q-number, or finite c-number and a horizontal axis representing the absence or presence of internal symmetry in the current algebra. The discussion covers models with c-number Schwinger terms without internal symmetry, the Sugawara model, models with operator Schwinger terms, models combining operator Schwinger terms and internal symmetry, the quark model, and ultralocal models. (JFP)

7921 WHAT WE HAVE LEARNED ABOUT REPRESENTING LOCAL NONRELATIVISTIC CURRENT ALGEBRAS. Sharp, D. H. (Univ. of Pennsylvania, Philadelphia). pp 87-98 of Local Currents and Their Applications. Sharp, D. H.; Wightman, A. S. (eds.). Amsterdam; North-Holland Publishing Company (1974).

The survey of local nonrelativistic current algebra covers representations with N particles in a volume V, distinguishing bosons from fermions, the N/V limit, the ground state expectation functional, multipliers, the exponentiated currents forming a group, free bosons in the N.V limit, functional differential equations determine representations of a local current algebra, interacting bosons, functional integration, free fermions in the N.V limit, interacting fermions, and free Bose and Fermi gases at finite temperature in statistical mechanics. (JFP)

7922 MACROSCOPIC VARIABLES. Krips, H. (Melbourne Univ., Parkville, Australia). Int. J. Theor. Phys.; 12: No. 1, 11-24(Jan 1975).

The problem of describing macroscopic variables in quantum theory is discussed. It is suggested that the "eigenspaces" of macroscopic variables be hyperspheres rather than closed linear subspaces. This is combined with the usual suggestion that macroscopic variables are nearly diagonal in the energy representation. The Schroedinger paradox is resolved in terms of this discussion. (auth)

7923 PROPOSITIONAL SYSTEMS AND MEASUREMENTS. II. Hellwig, K. E.; Krausser, D. (Technische Univ., Berlin). Int. J. Theor. Phys.; 10: No. 4, 261-272(Aug 1974).

A direct approach to propositional systems alternative to that of Jauch and Piron (Helvetica Physica Acta; 42: 842 (1969)) was given previously (Hellwig and Krausser. Int. J. Theor. Phys.; 9: 277 (1974)). The most difficult point is the foundation of the covering law. Independently of the latter holding true questions defined by a measurement process described in the propositional system of the apparatus coupled to the quantum object are considered. (auth)

7924 GENERALIZING ABRAHAM–LORENTZ EQUATION. Daboul, J. (Univ. of the Neger, Beersheba, Israel). Int. J. Theor. Phys.; 11: No. 3, 145–147(Nov 1974).

It is proved that runaway solutions persist if Abraham's force $-m(\ddot{x}-\ddot{x})$ is generalized by adding to it a finite number of terms which are linear in higher derivatives of x. The implication of this result to Eliezer's relativistic generalization (Rev. Mod. Phys.; 19: 147 (1947)) of the Lorentz–Dirac equation is discussed. (auth)

7925 BOUND STATES OF SPIN-½ PARTICLES FOR CERTAIN CENTRAL POTENTIALS. Sidharth, B. G. (St. Xavier's College, Calcutta). pp 107-110 of Proceedings of the Nuclear Physics and Solid State Physics Symposium. Bangalore, India; Indian Inst. of Science (1973).

From proceedings of the nuclear physics and solid state physics symposium; Bangalore, India (27 Dec 1973). See CONF-731229-P16B.

7926 CAUSAL PROPAGATION IN RELATIVISTIC WAVE EQUATIONS. Amar, V.; Dozzio, U. (Univ., Parma, Italy). Lett. Nuovo Cim.; 12: No. 17, 659-662(26 Apr 1975).

In the consideration of causal propagation of the solutions of relativistic equations for particles with arbitrary spin minimally coupled to the electromagnetic field problems arising where the propagation is not causal. The origin of these problems is clarified, by sufficient condition which guarantees causal propagation; this quite general condition can be used for constructing causal wave equations with arbitrary spins and masses. It is shown that certain previous results are particular cases of a more general sufficient condition which is proven. (JFP)

7927 CERTAIN INVARIANCE AND CONVERGENCE PROPERTIES OF THE PADE APPROXIMANT. Baker, G. A. Jr. (Cornell Univ., Ithaca, NY). Rocky Mt. J. Math.; 4: No. 2, 141-149(Spr 1974).

Theorems are discussed which indicate that while convergence in measure is the best that can be proved for the sequence as a whole, there is much more to be said about subsequences. It is concluded that the Pade conjecture remains today unproved and uncontradicted. (JFP)

Quantum Field Theories

Refer also to abstracts 7526, 7534, 7581, 7982, 7988, 7990, and 8000.

7928 (CONF-7306115-P1, pp C.I1–C.I39) REVIEW OF COMPUTATIONAL QED. Calmet, J. (CERN, Geneva). 1973.

From 3rd international colloquium on advanced computing methods in theoretical physics; Marseille, France (25 Jun 1973).

In third international colloquium on advanced computing methods in theoretical physics, Marseille, June 25–29, 1973. (Centre National de la Recherche Scientifique, 13- Marseille (France). Centre de Physique Theorique).

A review of the theoretical results on the electron and muon anomalous magnetic moments and on the Lamb shift in hydrogen is presented. Some of the computational problems arising in QED are briefly discussed. (auth)

7929 (CONF-7306115-P1, pp C.II1–C.II32) APPLICATIONS OF THE INFINITE MOMENTUM METHOD TO QUANTUM ELECTRODYNAMICS AND BOUND STATE PROBLEMS. Brodsky, S. J. (Stanford Univ., CA). 1973.

From 3rd international colloquium on advanced computing methods in theoretical physics; Marseille, France (25 Jun 1973).

In third international colloquium on advanced computing methods in theoretical physics, Marseille, June 25–29, 1973. (Centre National de la Recherche Scientifique, 13- Marseille (France). Centre de Physique Theorique).

The treatment of the infinite momentum method for quantum electrodynamics and bound state problems includes implementation of calculational rules for the TOPTh for quantum electrodynamics and bound state problems in the $P \to \infty$ frame. (JFP)

7930 (CONF-7306115-P1, pp C.V1–C.V14) NEW TECHNIQUES IN THE G-2 CALCULATIONS. Roskies, R. (Univ. of Pittsburgh). 1973.

From 3rd international colloquium on advanced computing methods in theoretical physics; Marseille, France(25 Jun 1973).

In third international colloquium on advanced computing methods in theoretical physics, Marseille, June 25–29, 1973. (Centre National de la Recherche Scientifique, 13- Marseille (France). Centre de Physique Theorique).

Some aspects of a new technique for the analytic evaluation of the sixth order magnetic moment in quantum electrodynamics are outlined. Some of the computational aspects and work now in progress are discussed. (JFP)

7931 (COO-1545-149) QUANTIZATION OF FIELDS OBEYING NONLINEAR CONSTRAINTS: THE MINIMALLY INTERACTING SPIN-$\frac{3}{2}$ FIELD. Mainland, G. B. (Ohio State Univ., Columbus (USA). Dept. of Physics). 1974. Contract E(11-1)-1545. 25p. Dep. NTIS $4.25.

A system consisting of an electromagnetic field interacting minimally with a massive Rarita–Schwinger spin-$\frac{3}{2}$ field is quantized to all orders in the coupling constant. The generators of the Poincare group are identified, and the field (anti)commutators are used to explicitly verify that the independent fields transform in accordance with the action principle. Because one has quantized the electromagnetic field in the (nonmanifestly covariant) Coulomb gauge this strongly suggests, but does not prove, covariance. The spin-$\frac{3}{2}$ field anticommutator is not positive definite and is in fact identical to the expression obtained when the electromagnetic field is taken to be external. While the nonlinear constraints which appear are relatively simple in comparison with many systems obeying such constraints, the constraint structure is sufficiently rich to illustrate some of the basic techniques required to quantize the fields and construct the Poincare generators. (auth)

7932 (EFI-TF-14(72)) SOME RELATIONS FROM γ_μ DIRAC MATRIX ALGEBRA. Grigoryan, R. P.; Tevikyan, R. V. (Erevanskij Fizicheskij Inst. (USSR)). 1972. 11p. INIS.

Some relations from γ_μ Dirac algebra which can be used in the calculation of the traces from any number of γ_μ matrices were compiled and developed. (tr-auth)

7933 (IC-74-5) ALGEBRA OF CASUALITY. Scharfstein, H. (International Centre for Theoretical Physics, Trieste (Italy)). Jan 1974. 42p. INIS.

A set of trilinear equal-time commutation relations is proposed as a generalized second quantization scheme for fields satisfying conventional statistics. The scheme specifies the bilinear equal-time commutation relations between distinct fields (a finite number for each spin for the representations considered) in addition to the commutation relations of fields with themselves. Multiplet schemes for a particular representation of "generalized fields" satisfying the trilinear equal-time commutation relations are studied. It is shown that generalized vacuum expectation values can be defined, and that the S matrix formalism can be developed for generalized fields. Differences with the conventional S matrix expansions are examined, in particular in connection with possible applications to renormalization procedures. A novel regularization method, based on the bilinear equal-time commutation relations between distinct fields, is considered. (auth)

7934 (IC-74-21) SUPER-GAUGE GROUPS. Fronsdal, C. (International Centre for Theoretical Physics, Trieste (Italy)). Mar 1974. 9p. INIS.

Following a recent suggestion by Wess and Zumino, and applying methods due to Salam and Strathdee, some spinorial transformation groups are studied, that is, groups that transform bosons into fermions and vice versa. Using chiral spinor variables, a super-field wave equation is given that conforms to the Fierz-Pauli principle. Neutrino gauge transformations are defined in close analogy with electromagnetic gauge transformations, and a minimal principle for interactions with neutrinos is proposed. (auth)

7935 (IC-74-36) SUPER-SYMMETRY AND NON-ABELIAN GAUGES. Salam, A.; Strathdee, J. (International Centre for Theoretical Physics, Trieste (Italy)). May 1974. 8p. INIS.

It is shown that the conventional Yang-Mills Lagrangian with the Yang-Mills field interacting with Majorana fermions belonging to the adjoint representation of an internal symmetry group like (SU(n) is super-gauge invariant. (auth)

7936 (IC-74-42) SUPERFIELDS AND FERMI-BOSE SYMMETRY. Salam, A.; Strathdee, J. (International Centre for Theoretical Physics, Trieste (Italy)). May 1964. 40p. INIS.

The realization of supergauge transformations on fields defined over an 8-dimensional space whose points are labelled by x_μ and the anticommuting Majorana spinor x_μ, is described. The

covariant derivative is defined and applied to the problem of decomposing superfields into irreducible (chiral) parts and to the problem of constructing "supersymmetric" Lagrangians. Further, it is shown how to build internal symmetries (both global and local) into these Lagrangians. An example is discussed in which the internal (global) symmetry is spontaneously violated giving rise to a supermultiplet of Goldstone particles (including fermions). When a local symmetry is broken the Higgs mechanism (for bosons and fermions) is shown to be operative. A possible solution to the problem of defining a conserved fermion number is indicated. (auth)

7937 (IC-74-53) ELECTRODYNAMICS AND SOURCE MODELS. Phares, A. G. (International Centre for Theoretical (Physics, Trieste (Italy)). Jun 1974. 7p. INIS.

It is shown that physical constraints can be obtained on source models making them not completely arbitrary. The ultraviolet behavior of spectral forms in connection with source models is also discussed. (auth)

7938 (IC-74-57) CLIFFORD ALGEBRAIC APPROACH TO SUPERFIELDS AND SOME CONSEQUENCES. Ktorides, C. N. (International Centre for Theoretical Physics, Trieste (Italy)). Jun 1974. 18p. INIS.

Frames provided by Clifford algebras ζ_n are considered for the purpose of expanding a field multiplet (containing, possibly, both bosons and fermions). After giving a brief-mainly geometrical-description of Clifford algebras, the main tools of the present scheme are introduced: a scalar product in ζ_n, a conjugation operation and a "Lorentz covariant derivative". It is described how these Clifford algebraic tools can be applied in order to obtain free massless Lagrangian expressions for a number of field theoretical models. It is also shown how gauge fields can arise within this scheme. It appears possible that the suggested formalism can lead naturally to spinor field operators as "gauge fields". A specific example which can lead to a two-component "gauge spinor" is discussed. Possible lines of investigation which could solidify this potentially rich approach are suggested. (auth)

7939 (IC-74-79) DEGREE OF DIVERGENCE OF FEYNMAN DIAGRAMS IN SUPERFIELD THEORIES. Capper, D. M.; Leibbrandt, G. (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1974. 17p. INIS.

General Feynman graphs called "supergraphs" are considered in the context of a cubic superfield interaction. A formula, valid to all orders of perturbation theory, is derived for the superficial degree of divergence of any such supergraph. It is shown that only (±) self-energy graphs are primitively divergent and that there are neither overlapping divergences nor divergent vertex diagrams in the theory. (auth)

7940 (ITP-74-41E) EQUATIONS FOR COEFFICIENT FUNCTIONS OF S-MATRIX IN $g(:\varphi^4:)_2$ THEORY AT INFINITE VOLUME. Rebenko, A. L. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1974. 31p. Dep. NTIS (US Sales Only) $4.75.

The equations for coefficient functions of the S-matrix are investigated at infinite volume in a Hilbert space of translationary invariant functions h^T. The existence of a solution of some approximate equations is proved. (auth)

7941 (ITP-74-76E) UNIQUENESS OF THE DYNAMICS OF CUT-OFF MODELS IN QUANTUM FIELD THEORY. Yakymiv, Ya. M. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1974. 12p. Dep. NTIS (US Sales Only) $4.00.

It is proved that the symmetric Wick monomials in creation and annihilation operators, defining the operators in the space of states, are essentially selfadjoint. If the kernels of the monomials defining the interaction Hamiltonians are smooth enough, it is then proved that the total Hamiltonian equal to the sum of the free and interaction Hamiltonians is also essentially self-adjoint. (auth)

7942 (ITP-74-115E) S-OPERATOR REPRESENTABILITY IN THE STRONG NORMAL FORM. Lomsadze, Yu. M.; Sabad, E. P.; Agranovskii, B. A. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1974. 15p. Dep. NTIS (US Sales Only) $4.00.

It is proven that, via the boundedness of the $\hat{S}$-operator and its invariance under the time translations and the spectrality axiom in the strong form, this operator is representable in the strong normal form on the set of all completely finite vectors. The coefficient functions of the $\hat{S}$-operator are rigorously introduced both in the $\vec{p}$- and in the x-spaces. (auth)

7943 (ITP-74-153P) NON-GAUSSIAN HOMOGENEOUS RANDOM FIELDS AND THEIR APPLICATION IN QUANTUM FIELD THEORY. I. Gonchar, N. S.; Matskiv, R. S. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1974. 32p. (In Russian). Dep. NTIS (US Sales Only) $4.75.

Non-Gaussian homogeneous random fields from the homogeneous Gaussian field. For this purpose are derived the equations for characteristic functions of measures absolutely continuous with respect to Gaussian measure. The unique solvability of such equations is proved. The obtained solution is analytical function of the parameter g. The equations for characteristic functions are well defined and have a unique solution in the case when the density of the measure absolutely continuous with respect to a Gaussian measure is meaningless. It is the case when the Gaussian homogeneous random field is considered in infinite volume. The results obtained allow one to define the full set of characteristic functions in infinite volume. This gives one the possibility to define a new non-Gaussian homogeneous random field. (auth)

7944 (JINR-E2-8587) CAUSALITY IN QUANTUM ELECTRODYNAMICS. Shirokov, M. I. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 24p. Dep. NTIS (US Sales Only) $4.25.

The problem of whether the theory is causal in the sense that signals do not travel faster than the light is discussed. A quantum-mechanical definition of this causality principle is proposed. The local observables like field intensities $\vec{E}(x)$, $\vec{H}(x)$ and current density $j_\mu(x)$ behave causally in this sense. Examples are given of other densities which have a physical interpretation (number operator density for electrons, for example) and propagate with a superluminary velocity. This means that the local commutativity of the operators A_μ and Ψ does not prevent the superluminar signal velocity. (auth)

7945 (JINR-E2-8593) INVERSE HIGGS PHENOMENON IN NONLINEAR REALIZATIONS. Ivanov, E. A.; Ogievetskii, V. I. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 28p. Dep. NTIS (U. S. Sales Only) $4.50.

In theories with nonlinearly realized symmetry it is possible in a number of cases to eliminate some initial Goldstone and gauge fields by putting appropriate Cartan forms zero that is called the inverse Higgs phenomenon. A general treatment of the inverse Higgs phenomenon for gauge and space-time symmetries is given, and four instructive examples which are the elimination of unessential gauge fields in chiral dynamics and in nonlinearly realized supersymmetry and also the elimination of unessential Goldstone fields in the spontaneously broken conformal and projective symmetries are considered. (auth)

7946 (JINR-E2-8681) PROJECTION OPERATORS AND SUPPLEMENTARY CONDITIONS FOR SUPERFIELDS WITH AN ARBITRARY SPIN. Sokatchev, E. S. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 21p. Dep. NTIS (U. S. Sales Only) $4.25.

It is shown that a superfield with an external spin j and a non-vanishing mass contains four irreducible representations of the supersymmetry algebra. A general method is proposed for extracting these irreducible multiplets out of the superfield using projection operators constructed with the help of the Casimir operators. The same decomposition is expressed in terms of supplementary differential conditions. (auth)

7947 (JINR P2-8689) NUMERICAL METHODS FOR SOLVING A CLASS OF SINGULAR BOUNDARY VALUE PROBLEMS IN QUANTUM MECHANICS AND FIELD THEORY. Mavlo, D. P.; Puzynin, I. V.; Filippov, A. T. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 48p. (In Russian). Dep. NTIS (US Sales Only) $5.50.

A general formulation of certain singular boundary value problems of quantum mechanics and field theory is given. The problem may be formulated as a system of integral equations or, equivalently, as a system of differential equations with corresponding boundary conditions. A general method for solving such a problem, based on the continuous analog of Newton's method, is suggested. One simple boundary value problem, which arised in the theory of composite hadrons, is investigated in detail. Using this problem as a typical example the method of analytic continuation of the numerical solution defined on the real axis into the whole complex plane is formulated. (auth)

7948 (JINR-P2-8749) ASYMPTOTICAL PROPERTIES OF KAELLEN-LEHMANN REPRESENTATION. Krasnikov, N. V.; Chetyrkin, K. G. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 21p. (In Russian). Dep. NTIS (US Sales Only) $4.25.

The automodel behavior of the spectral functions of the scalar field was studied on the basis of the Kallen-Lehmann representations. The investigation has been performed at the Laboratory of Theoretical Physics, JINR. (auth)

7949 (NBI-HE-74-17) EFFECTIVE COUPLING EXPANSION OF NON-ABELIAN GAUGE THEORIES. Olesen, P. (Niels Bohr Institutet, Copenhagen (Denmark)). Nov 1974. 36p. INIS.

Unrenormalized non-Abelian gauge theories are investigated

using renormalization group methods. It is shown that the bare coupling $g_0(\Lambda,g)$ approaches the effective coupling for large values of the cutoff Λ. It is also shown that the unrenormalized propagator (and the 3- and 4-point vertices) approaches the bare propagator for large momenta. The way in which the renormalization group, for asymptotically free theories, can be understood in the case of large (spacelike) momenta as a perturbation expansion of the unrenormalized theory is discussed. The assumption that $\beta(g)$ has a second zero for $g = g_1 \neq 0$ is investigated in this framework and is shown to lead to an inconsistency (the arguments are not rigorous). On the other hand, the assumption that the effective coupling approaches infinity at large distances does not lead to an inconsistency. It is therefore concluded that the effective coupling must become infinitely strong in the infrared region. (auth)

7950 (RRK-74-6) NEUTRAL-VECTOR FIELD THEORY WITH INVARIANT GAUGE FAMILIES. Yokoyama, K. (Hiroshima Univ., Takehara (Japan). Research Inst. for Theoretical Physics). Apr 1974. 29p. INIS.

By a generalization of canonical quantum electrodynamics with invariant one-parameter gauge families, a wide theory of neutral vector fields is formulated in a unified way that describes massive and massless fields on the same basis. Similarly to the case of quantum electrodynamics, there exist two invariant gauge families in the sense that any two gauges belonging to the same family are connected with each other by a generalized q-number gauge transformation. It is shown that the theory is manifestly renormalizable and the unitarity of the S-matrix is guaranteed by conservation of currents. Renormalization problems in this formalism are investigated. (auth)

7951 (RRK-74-8) GAUGE STRUCTURE OF NEUTRAL-VECTOR FIELD THEORY. Kubo, R.; Yokoyama, K. (Hiroshima Univ., Takehara (Japan). Research Inst. for Theoretical Physics). Jul 1974. 30p. INIS.

General aspects of gauge structure of neutral-vector field theory are investigated from an extended standpoint, where massive vector fields are extended from the electromagnetic fields in a general gauge-formalism controlled by a gaugeon field. All results obtained are shown to have their unique massless limits. It is shown that a generalized q-number gauge transformation for fields makes the theory invariant in cooperation with a simultaneous transformation for relevant gauge parameters. A method of differentiation with respect to a gauge variable is found to clarify some essential features on the gauge structure. Two possible types of gauge structure also emerge correspondingly to the massless case; in connection with these types, simple and typical examples are presented. A neutral-vector field theory proposed in a preceding paper is included in the present framework as the most preferable case. (auth)

7952 PROBLEMS IN RELATIVITY. Wu-li; 3: No. 5, 319-320(18 Oct 1974). (In Chinese).

A number of selected letters to the editor concerning views on the theory of relativity are presented. The central issue discussed in the letters is the philosophical interpretation of the theory of relativity and certain subjectivistic views which the theory implies. Specifically, the postulate of the speed of light being the limiting speed is criticized. It is urged that this postulate be carefully reevaluated and studied from the materialistic viewpoint. (auth)

7953 HELMHOLTZ CONDITIONS FOR THE EXISTENCE OF A LAGRANGE FORMALISM. Engels, E. (Rijksuniversiteit, Ghent). Nuovo Cim.; 26B: No. 2, 481-492(11 Apr 1975).

The Helmholtz conditions are necessary and sufficient for a given set of n second-order ordinary differential equations to be derivable from a variational principle of Hamilton's type. Two alternative forms are given which make practical verification less tedious for large n, and permit an easy construction of the Lagrangian. The equivalence to the analogous conditions in Hamilton's formalism is proved. (auth)

7954 DIPOLE FIELD SOLUTION OF MAXWELL'S EQUATIONS IN THE SCHWARZSCHILD METRIC. Linet, B. (Univ., Paris). J. Phys., A (London); 8: No. 3, 328-333(Mar 1975).

The dipole solution of Maxwell's equations in the Schwarzschild metric is found as a convergent series for $r > 2m$. The validity of this representation by series is proved by a complete study of its convergence and differentiability. (auth)

7955 NEW APPROACH TO INTERACTING FIELDS. von Westenholz, C. (Univ., Mainz). Int. J. Theor. Phys.; 10: No. 6, 391-433(Sep 1974).

A model for a description of interaction, which involves particle creation, can be given as follows: a smooth finite-dimensional manifold M constitutes the configuration space of some interacting system. The concept of an interacting field is formulated in terms of two-component objects which consist of a physical and a topological field component which are "derived" from M. The interaction is described in terms of the topological linking number of the topological field components and in terms of the intrinsic field equations. This scheme provides a geometrical description of strong interactions and gives a structural analysis of Gell-Mann current fields. A differential topological formulation of Noether's theorem can be obtained. Moreover a consistent description of electromagnetic interactions which sheds a new light on the mechanism of virtual processes is available. This description results in an estimate of the fine structure constant $\alpha = e^2/\hbar \cdot c$). (auth)

7956 INVARIANT NONCANONICAL MAPPINGS OF SINGULAR THEORIES. II. Bergmann, P. G.; Komar, A. (Univ. of Syracuse, NY). Gen. Relativity Gravitation; 6: No. 1, 3-7(Feb 1975).

From 7th international conference on gravitation and relativity; Tel-Aviv, Israel (Jun 1974).

It was shown that in singular theories (i.e., theories incorporating constraints) noncanonical infinitesimal mappings that map equivalence classes intact on each other lead to the divergence of a vector field associated with the mapping constant throughout the equivalence class. The infinitesimal mappings form the germ of the group of finite mappings of equivalence classes on each other that change the form of the symplectic tensor field. Any noncanonical coordinate system on phase space thus obtained defines a scalar density field that is constant over an equivalence class. The constant of the motion obtained earlier represents the infinitesimal deviation of this new field from unity. (auth)

7957 INTEGRAL GEOMETRICAL STRUCTURES ON MINKOWSKI SPACE–TIME AND YANG–MILLS SYMMETRIES. Camenzind, M. (Univ., Bern). Int. J. Theor. Phys.; 10: No. 3, 197-216(Aug 1974).

Yang–Mills potentials and fields on Minkowski space–time are equivalent to connections and curvatures for corresponding principle fibre bundles over Minkowski space–time. Therefore, the usual Yang–Mills field equations, together with Bianchi's identities, define transport equations for the connection and curvature with respect to a given observer field (inertial system). This equivalence is worked out; furthermore, the notion of symmetric, particularly spherically symmetric Yang–Mills connections is transposed to the bundle description. It is shown that the restrictions on the Yang–Mills connection imposed by spherical symmetry are by no means as severe as assumed by Ikeda and Miyachi (Prog. Theor. Phys.; 27: 474 (1962)). (auth)

7958 CONTACT TRANSFORMATIONS AND CONFORMAL GROUP. I. Relativistic Theory. Boya, L. J.; Cervero, J. M. (Zaragoza Univ., Spain). Int. J. Theor. Phys.; 12: No. 1, 47-54 (Jan 1975).

The contact group of plane hyperbolic conformal geometry is found and identified as a step to a better understanding of conformal invariance in physics. (auth)

7959 REMOVAL OF THE QUARTIC POTENTIAL IN GAUGE THEORIES AND ASYMPTOTIC FREEDOM. Hsu, J. P. (Univ. of Texas, Austin). Lett. Nuovo Cim.; 12: No. 13, 503-507(29 Mar 1975).

A new method based on the Lagrange-multiplier field is used to show that the quartic potential can be removed from the Lagrangian and that a renormalizable theory can be constructed for massive vector bosons with distorted-gauge symmetry and without using spontaneous symmetry breakdown. This theory is explicitly shown to be unitary and gauge independent up to two-loop diagrams. Furthermore, the theory may be asymptotically free, according to previous results. All these come about because the dynamics of interaction of particles is interlocked with the distorted gauge symmetry. (JFP)

7960 UNIVERSAL LENGTH AND VALIDITY OF SPECIAL RELATIVITY. Kim, D. Y. (Stanford Univ., CA). Lett. Nuovo Cim.; 12: No. 15, 591-596(12 Apr 1975).

A reexamination is proposed for the validity of the Lorentz invariance in terms of a previously suggested formalism but including the effect of radiative corrections. The presently available energies enable one to carry out the proposed tests. Also it is reported that a characteristic length of $0.68(10)^{-16}$ cm was evaluated by using the nonlocal field formulation of the CP violation with the latest observed CP violating parameters. The relation between the characteristic length and a possible violation of the Lorentz invariance is also discussed. (JFP)

7961 RELATIVISTIC QUANTUM STATISTICAL MECHANICS IN TWO-DIMENSIONAL SPACE–TIME. Hoeegh-Krohn, R. (Univ., Oslo). Prepr. Ser., Inst. Math., Univ. Oslo; No. 22, 1-45(15 Oct 1973).

A boson field is constructed in two-dimensional space-time with polynomial or exponential interactions and without cut-offs, and the thermodynamic limit of the positive temperature state or the Gibbs state at temperature $1/\beta$ is studied. It is proved that at positive temperatures, i.e., $\beta < \infty$, there are now phase transitions and the thermodynamic limit exists and is unique for all interactions. It turns out that the Schwinger functions for the Gibbs state at temperature $1/\beta$ are, after interchange of space and time, equal to the Schwinger functions for the vacuum, or temperature zero state, for the field in a periodic box of length β, and the lowest eigenvalue for the energy of the field in a periodic box is simply related to the pressure in the Gibbs state at temperature $1/\beta$. (auth)

7962 GREEN'S FUNCTION APPROACH TO QUANTUM FIELD THEORY IN LOCALLY CONVEX SPACE AND QUESTION OF UNIQUENESS. Yoshimura, T. (King's Coll., London). Int. J. Theor. Phys.; 11: No. 6, 379-386(Dec 1974).

If the set of many point functions $((G_2 - G^0, G_4, \ldots, G_N))$ satisfies the set of equations arising in the ϕ^4 model of quantum field theory, then for a given G_N the set $((G_2 - G^0, G_4, \ldots, G_{N-2}))$, is unique in the domain $V = \{((G_2 - G^0, G_4, \ldots, G_{N-2})) : |((G_2 - G^0, G_4, \ldots, G_{N-2}^{(\mathrm{irred})}))|_i < f\, g^{-} - {}_i\epsilon_\tau\}$ in a locally convex space equipped with a directed family of semi-norms, where f are positive numbers that depend on details of G_N, and $g \ll 1$ is the effective coupling constant. (auth)

7963 TRACE AND THE RELATIVISTIC SCALAR PRODUCTS INVOLVING DIRAC MATRICES γ/SUB i/ AND THE 4×4 UNIT MATRIX. Sarkar, S. (Indian Association for the Cultivation of Science, Calcutta). Int. J. Theor. Phys.; 10: No. 5, 291-296 (Sep 1974).

The relativistic scalar products like $\gamma_i^u\gamma_i$, $\mathrm{Tr}(\gamma_i u)\ \mathrm{Tr}(\gamma_i \nu)$ and $\mathrm{Tr}(\gamma_i\gamma_i u)\ \mathrm{Tr}(\gamma_i\gamma_i \nu)$ are dealt with. Any string like u and ν involve Dirac matrices in the manner $u = \Pi_{r=1}^{n} a_r$ where the element $a_r = a_{ri}\gamma_i + ia_{r5}$ i.e., a_r in general involves a term ia_{r5} which is multiplied by a 4×4 unit matrix. $\mathrm{Tr}(\gamma_b u)\ \mathrm{Tr}(\gamma_b \nu)$ where the suffix "b", unlike the dummy suffixes i and j, does not imply any summation and can assume any specific value from 1 to 5 are evaluated. Some reduction formulas for the evaluation of $\mathrm{Tr}(\gamma_5 u)$ and Tr(u) were obtained. (auth)

7964 ANOTHER FORM OF EINSTEIN'S ADDITION LAW OF VELOCITIES. Kaliappan, P. (Nalamuthu Gounder Mahalingam Coll., Pollachi, Tamil Nadu, India). Int. J. Theor. Phys.; 10: No. 3, 189-196(Aug 1974).

The velocity of a moving particle is treated in a different way. Accordingly a new form for Einstein's addition law of velocities is given. Lorentz transformations are found from this aspect. The possibility of another way of recognition of the correlation between mass and energy is explained. (auth)

7965 ABOUT THE STRANGE BEHAVIOR OF TACHYONS. Arzelies, H. Compt. Rend., Ser. A, B; 279: No. 13, 535-536 (23 Sep 1974). (In French).

The usual equation of tachyon dynamics leads to contradictory results. Three hypotheses are suggested to eliminate these contradictions. (FR)

7966 SECOND-ORDER SCALAR-TENSOR FIELD EQUATIONS IN A FOUR-DIMENSIONAL SPACE. Horndeski, G. W. (Univ. of Waterloo, Ont.). Int. J. Theor. Phys.; 10: No. 6, 363-384(Sep 1974).

Lagrange scalar densities which are concomitants of a pseudo-Riemannian metric tensor, a scalar field and their derivatives of arbitrary order are considered. The most general second-order Euler-Lagrange tensors derivable from such a Lagrangian in a four-dimensional space are constructed, and it is shown that these Euler-Lagrange tensors may be obtained from a Lagrangian which is at most of second order in the derivatives of the field functions. (auth)

7967 EXTENDED APPROACH TO THE FIELD-THEORETICAL TIME OPERATORS. Papp, E. (Institutul Politechnic, Cluj). Int. J. Theor. Phys.; 10: No. 6, 385-389(Sep 1974).

It is proved that within the two- or three-dimensional formulations of quantum field theory the possibility exists of performing the time description in the whole Hilbert space of the particle and of the antiparticle states respectively. In contrast to the Klein-Gordon field, the present time description of the whole Dirac particle-antiparticle field may be adequately performed only in the one-dimensional case. (auth)

7968 PHYSICAL EFFECTS ASSOCIATED WITH THE MICROSCOPIC VIOLATION OF THE STRONG PRINCIPLE OF EQUIVALENCE IN THE DIRAC-EINSTEIN EQUATIONS. Leiter, D. (Central Michigan Univ., Mt. Pleasant); Chapman, T. C. Lett. Nuovo Cim.; 12: No. 16, 633-637(19 Apr 1975).

It is pointed out that since in principle the strong principle of equivalence is violated by a minimally coupled Dirac-Einstein theory and since the Eotvos-Dicke experiments only test the validity of the weak principle of equivalence, one is lead to the conclusion that the question of the physical reality of the strong principle of equivalence and its associated minimal coupling criteria is still an open question. Therefore, one is tempted to relax the constraint of minimal coupling in the Dirac-Einstein theory. This possibility is treated. (JFP)

7969 MOTIONS OF ELECTRIC CHARGES FROM SUB- AND SUPERLUMINAL SOURCES IN AN ELECTROMAGNETIC FIELD. Lemke, H. (Strasse des Friedens, Freiberg i. B.). Lett. Nuovo Cim.; 12: No. 16, 619-625(19 Apr 1975).

The possibility of using the real superluminal Lorentz transformations in four-dimensional space-time to describe tachyons existing in Euclidean space without a single preferred direction in space by generalizing the usual notions of space and time. Also possible experimental searches for tachyons are suggested. (JFP)

7970 SUMMING SOFT PHOTONS AS AN INCLUSIVE SUM USING MUELLER'S THEOREM. Toernqvist, N. A. (Helsinki Univ., Finland). Lett. Nuovo Cim.; 13: No. 1, 34-38(3 May 1975).

An application of Mueller's generalized optical theorem, well known in multiparticle hadronic physics, to the classical problem of removing infrared divergences. New results are not achieved except those of simplicity and elegance. (JFP)

7971 ADLER-BELL-JACKIW TRIANGLE ANOMALY IN THE MASS DIFFERENTIATION RENORMALIZATION SCHEME. Mercaldo, L. (Univ., Salerno, Italy). Lett. Nuovo Cim.; 13: No. 1, 1-5(3 May 1975).

It is shown that in the regularization scheme the Adler-Bell-Jackiw triangle anomaly takes automatically the well known value and is strictly connected with a violation of the principle of permanence, which is stated as: a regularization procedure applied to a regular quantity must leave it invariant. (JFP)

Gravitation and General Relativity

Refer also to abstracts 7588, 7589, and 7957.

7972 (CONF-7306115-P1) THIRD INTERNATIONAL COLLOQUIUM ON ADVANCED COMPUTING METHODS IN THEORETICAL PHYSICS, MARSEILLE, JUNE 25-29, 1973. Visconti, A. (ed.). (Centre National de la Recherche Scientifique, 13- Marseille (France). Centre de Physique Theorique). 1973. vp.

From 3rd international colloquium on advanced computing methods in theoretical physics; Marseille, France (25 Jun 1973).

Separate abstracts were prepared for fifteen sections of the report. (MOW)

For abstracts of individual sections see: 6150, 6151, 7428, 7429, 7521, 7540-7542, 7903, 7904, 7928-7930, 7973, and 7974.

7973 (CONF-7306115-P1, pp B.III0-B.III22) GENERAL RELATIVITY AND SYMBOLIC ALGEBRA. Barton, D. (Cambridge Univ., Eng.). 1973.

From 3rd international colloquium on advanced computing methods in theoretical physics; Marseille, France (25 Jun 1973).

In third international colloquium on advanced computing methods in theoretical physics, Marseille, June 25-29, 1973. (Centre National de la Recherche Scientifique, 13- Marseille (France). Centre de Physique Theorique).

Manipulative algebra systems are used in the calculations of general relativity. Certain geometrical constraints are imposed upon the space (e.g., axial symmetry) and other constraints on the distribution of matter (e.g., irrotational flow), and then it is discovered from the field equations those solutions consistent with the imposed conditions. (JFP)

7974 (CONF-7306115-P1, pp B.VI0-B.VI36) ALAM/CLAM AND SOME APPLICATIONS OF COMPUTER ALGEBRA SYSTEMS TO PROBLEMS IN GENERAL RELATIVITY. Russell-Clark, R. A. (Cambridge Univ., Eng.). 1973.

From 3rd international colloquium on advanced computing methods in theoretical physics; Marseille, France (25 Jun 1973).

In third international colloquium on advanced computing methods in theoretical physics, Marseille, June 25-29, 1973. (Centre National de la Recherche Scientifique, 13- Marseille (France). Centre de Physique Theorique).

The ALAM/CLAM system for general relativity is discussed. A historical survey is given of the development of this system. Four large nonstandard applications are described. Also the details of the CAMAL system are given. (JFP)

7975 (IC-73-146) NULL DYNAMICS OF GENERAL RELATIVITY IN THE RAY GAUGE. Aragone, C.; Chela Flores, J.

(International Centre for Theoretical Physics, Trieste (Italy)). Oct 1973. 21p. INIS.

The dynamics of general relativity is considered as the evolution of the field variables along a null-time coordinate. Starting from the first-order Palatini action, algebraic constraints are eliminated, and differential constraints found after choice of the ray gauge condition $g_{1\nu} = 0$. The dynamical role of field components is analyzed. It is given the form of the unconstrained action and of the associated null energy j^u for the gauge $g_{uv} = -1$ in terms of only two dynamical variables, g^T_{ij} and π^T_{ij}, the minimum number of variables expected for describing the dynamics of the self-interacting helicity 2-massless Einstein field. (auth)

7976 (IC-74-35) EFFECTIVE POTENTIALS NEAR A KERR–NEWMAN NAKED SINGULARITY. Bergamini, R. (International Centre for Theoretical Physics, Trieste (Italy)). May 1974. 5p. INIS.

Effective potentials are studied around naked singularities. The general case of a field endowed of charge and angular momentum (Kerr-Newman metric) is considered together with the two special cases of zero charge and zero angular momentum (Kerr and Reissner-Nordstroem metrics). It is found that the presence of repulsive effects depends on the values of the parameters characterizing the field and the test particle. (auth)

7977 RELEVANCE OF GENERAL RELATIVITY WITH TORSION AT HIGHEST MATTER DENSITIES AND IN MICROPHYSICS. Hehl, F. W. (Princeton Univ., NJ). Gen. Relativity Gravitation; 6: No. 1, 123-127(Feb 1975).

From 7th international conference on gravitation and relativity; Tel-Aviv, Israel (Jun 1974).

General relativity with spin and torsion (U_4-theory) is discussed. Conventional general relativity (GR) and U_4-theory cannot be distinguished with the present experimental techniques. At high matter densities and in microphysics, however, U_4-theory gives different answers. The former is interesting in connection with gravitational collapse and the singularity theorems, the latter with respect to the quantization of the gravitational field. (auth)

7978 INVESTIGATION OF SINGULARITIES IN GENERAL RELATIVITY. Bera, K.; Datta, B. K. (Presidency Coll., Calcutta). Gen. Relativity Gravitation; 6: No. 1, 129-139(Feb 1975).

From 7th international conference on gravitation and relativity; Tel-Aviv, Israel (Jun 1974).

The problem of singularities for a nonsymmetric and isentropic motion of a perfect fluid under the assumption of adiabatic thermodynamic processes is investigated from the standpoint of a local observer. It is shown that, whatever the distribution of matter might be, there occurred a singularity in the past in the nonrotating parts of the universe, and it must occur again in the future if the universe is closed. It is further shown that the occurrence of a singularity in a rotating fluid seems inevitable, when the relativistic equation of state is considered, because of extremely high concentration of rest mass, though the possibility of its avoidance may not be ignored. (auth)

7979 FIELD THEORY OF GRAVITATION. Yilmaz, H. (Perception Tech. Corp., Winchester, MA). Nuovo Cim.; 26B: No. 2, 577-591(11 Apr 1975).

A field theory of gravitation where the stress-energy tensor of gravity contributes to geometric curvatures is described. The field is locally Lorentz covariant, namely in an infinitesimally small laboratory (not necessarily freely falling) the equations are formally the same as they would be in special relativity. The theory reproduces all known gravitational effects correctly and has experimental consequences differing from those of the Einsteinian theory. (auth)

7980 EXTENSION OF NEWTONIAN GRAVITATION THEORY. Cole, K. D. (La Trobe Univ., Bundoora, Australia). Nuovo Cim.; 26B: No. 2, 370-376(11 Apr 1975).

The energy density of a Newtonian gravitational field is shown to be $-g^2/8\pi G$, where g is the local acceleration due to gravity and G the universal constant of gravitation. In the case of a spherically symmetric object this causes a departure from the inverse square law for g. Allowance for this gravitational energy also introduces one to objects a critical radius of size $GM/2c^2$, where M is the mass. Allowance for the gravitational energy of the sun produces a classical advance of the perihelion of a planet at the rate $1/12$ of that found in general relativity. It is also shown that direct application of Sommerfeld's fine-structure theory to gravitation shows an advance of the perihelion of a satellite orbit which is $1/6$ that found in general relativity. The theory defines a gravitational fine-structure constant $\alpha_G = Gm^2/\hbar c$, where m is the mass of a hydrogen atom. α_G determines the rate of perihelion advance for an orbit in Sommerfeld's theory. (auth)

7981 STRONG AND WEAK GRAVITY: A CONTEXT FOR UNBIASED BIREFRINGENCE. Hammel, W. C.; Lubkin, E. (Univ. of Wisconsin, Milwaukee). Nuovo Cim.; 26B: No. 2, 377-395 (11 Apr 1975).

Reasons are given for dealing with a 2-metric relativity. Then one gives all of the constant solutions for a 5-parameter family of Lagrangian models. These include solutions for which the two null cones do not coincide. (auth)

7982 QUANTIZATION OF SELF-GRAVITATING FIELDS OF INTEGRAL SPIN. I. Scalar and Vector Fields. Christodoulou, D. (International Centre for Theoretical Physics, Trieste, Italy). Nuovo Cim.; 26B: No. 2, 335-369(11 Apr 1975).

The generalized chronos principle is introduced and the problem of quantization of self-gravitating fields is solved in the case of fields of integral spin. (auth)

7983 COSMOLOGICAL MODEL IMPOSED BY A UNIFIED THEORY. Goded, F. (Escuela Tecnica Superior de Ingenieros Industriales, Madrid). Gen. Relativity Gravitation; 6: No. 1, 119-121(Feb 1975).

From 7th international conference on gravitation and relativity; Tel-Aviv, Israel (Jun 1974).

It was shown (Goded. Gen. Relativ. Gravitation.; 6: 115-118 (1975)) that a free gravitational field may be formulated by the set of equations: $T^{\mu\nu}|_\nu = 0, {}^*T^{\mu\nu}|_\nu = 0$ and $R_{\mu\nu} = 0$ where the antisymmetric tensor $T_{\mu\nu}$ represents the inverse square forces of Newtonian theory. Some consequences derived from the solution of the cosmological problem arrived at through this new formulation of the gravitational field are solved. (UK)

7984 AMBIGUITIES OF DIMENSIONAL REGULARIZATION SCHEME. Nouri-Moghadam, M.; Talyor, J. G. (King's Coll., London). J. Phys., A (London); 8: No. 3, 334-346(Mar 1975).

The dimensional regularization technique is used to evaluate one-loop corrections to gravitational self-interaction. The application of such a scheme contains certain ambiguities which are presented and discussed. Attempts to remove these ambiguities have not yet proved successful. (auth)

7985 EQUIVALENCE PRINCIPLE: 60 YEARS OF A MISUSE. Bishop, N. T.; Landsberg, P. T. (Univ. of Southampton, Eng.). Nature (London); 252: No. 5483, 459-460(6 Dec 1974).

It is stated that ever since Einstein introduced the equivalence principle and used it, in conjunction with the Doppler effect, to derive the gravitational redshift of spectral lines, the argument has been an ingredient of many expositions of relativity theory. It is shown that on this point Einstein was in error, although the result found is correct (to first order). (auth)

7986 CLASSIFICATION OF SINGULARITIES. Clarke, C. J. S. (Cambridge Univ., Eng.). Gen. Relativity Gravitation; 6: No. 1, 35-40(Feb 1975).

From 7th international conference on gravitation and relativity; Tel-Aviv, Israel (Jun 1974).

Two definitions of the strength of a singularity in space-time are described and compared, and the possibility of extending the ideas to stronger singularities, using space-times of low differentiability, is explored. (auth)

7987 GYRON FIELD: GRAVITATIONAL ANALOGUE OF MAGNETIC FORCE. Salisbury, W. W.; Menzel, D. H. (Harvard Coll. Observatory, Cambridge, MA). Nature (London); 252: No. 5485, 664-665(20 Dec 1974).

The existence of a gravitational force is postulated that is dependent on the relative velocities of moving bodies, as well as on their masses, and it is suggested that this force be referred to as the "Gyron force." It applies to translational motion as well as to rotational motion, and may be regarded as a gravitational equivalent of a magnetic field. As derived the force is always repulsive, and its derivation employs apparent mass rather than rest mass, in terms of special relativity. It is pointed out that the existence of forces associated with moving, and especially rotating, masses strongly supports the existence of gravitational waves, and such waves must be quadrupole in character. (UK)

7988 NEW DEVELOPMENTS IN THE THEORY OF GRAVITY INTERACTING WITH QUANTIZED FIELDS. Parker, L. (Univ. of Wisconsin, Milwaukee). Gen. Relativity Gravitation; 6: No. 1, 21-27(Feb 1975).

From 7th international conference on gravitation and relativity; Tel-Aviv, Israel (Jun 1974).

Renormalization in the theory of a quantized scalar field interacting with the classical Einstein gravitational field is discussed. The scalar field obeys the generalization of the Klein-Gordon equation which is conformally invariant in the limit of vanishing mass. A generalized Kasner metric corresponding to an anisotropic expansion of the universe is considered. Results obtained are described, which show explicitly how the infinities appearing in the expectation value of the energy-momentum tensor can be absorbed through renormalization of the cosmological constant and the coefficients of a quadratic tensor appearing in a slightly

generalized form of the Einstein equation. There is also a finite renormalization of the gravitational constant. (auth)

7989 TOPICS ON SPACE–TIME TOPOLOGY. II. Whiston, G. S. (Univ. of Durham, Eng.). Int. J. Theor. Phys.; 11: No. 5, 341-351(Dec 1974).

Closed, compact, oriented, Lorentzian four-manifolds are investigated using elementary cobordism theory. The groups of cobordism classes of such manifolds under various cobordism relations are calculated. Oriented vector cobordism classes form an infinite free cyclic group, and oriented cobordism classes form a subgroup of index two in the four-dimensional oriented cobordism group. The properties of compact five-manifolds bounded by closed, compact, oriented, Lorentzian four-manifolds are investigated, and some speculations made on their possible interpretation. (auth)

7990 FIVE-DIMENSIONAL SPACE–TIME: MASS AND THE FUNDAMENTAL LENGTH. Edmonds, J. D. (Univ. of California, San Diego). Int. J. Theor. Phys.; 11: No. 5, 309-315(Dec 1974).

Relativistic physics is described by a sixteen-component hypercomplex number system which reduces to the eight-component complex quaternion system when rest mass → 0. Rest mass is identified with a scale setting, cyclic fifth dimension. The Lorentz group is generalized to rotations in five dimensions, a ten-parameter group. Special relativity and general relativity are tentatively welded into one unified covariance scheme in five-dimensional space–time. (auth)

7991 SOME REMARKS ON ORTHONORMAL TETRAD TRANSPORT. Krause, J. (Universidad Catolica de Chile, Santiago). Int. J. Theor. Phys.; 12: No. 1, 35-45(Jan 1975).

Some general features of orthonormal tetrad transport along time-like curves are considered while emphasizing the kinematical meaning of the "vierbein" transport process. The issue is further illustrated by comparing Frenet-Serret transport with Fermi–Walker transport. (auth)

7992 COMMON SOLUTIONS OF THE EINSTEIN AND BRANS–DICKE THEORIES. Tupper, B. O. J. (New Brunswick Univ., Fredericton, Canada). Int. J. Theor. Phys.; 11: No. 5, 353-356 (Dec 1974).

It is shown that nontrivial solutions common to the vacuum field equations of the Einstein and of the Brans–Dicke theories necessarily represent pp-waves and the set of all common solutions is precisely the set of all pp-wave solutions of the Einstein equations. The form of the associated scalar field is found and is shown to be singular when $\omega < -1$. (auth)

7993 INTRODUCTION TO THE THEORY OF LOCAL TWISTORS. Dighton, K. (County Technical Coll. Guildford, Surrey, Eng.). Int. J. Theor. Phys.; 11: No. 1, 31-43(Oct 1974).

The formation of local twistors, which has developed from the twister algebra, and extends some of the basic twistor concepts to curved space-time. Essentially, the central ideas are to define a twistor space at each point of the space-time, and to define a covariant derivative so that an operation of local twistor transport is possible; this leads to the definition of a conformally invariant curvature twistor. Some conformally invariant spinors are discussed. (auth)

7994 TEORIYA OTNOSITEL'NOSTI I GRAVITATSIYA. (Theory of Relativity and Gravitation. Meeting of Moscow Society of Naturalists, Moscow, USSR, April 26–27, 1974). Stanyukovich, K. P. (ed.). Moscow; Izdatel'stvo Nauka Glavnaya Redaktsiya Vostochnoi Literatury (1974). 67p. (CONF-740493–).

Twelve articles are compiled. Separate abstracts were prepared for seven of the articles. (JSR)

For abstracts of individual papers see: 7371, 7372, 7556, 7557, and 7995–7997.

7995 NOETHER THEOREM FOR THE CHAPLYGIN EQUATION. Karimov, A. U.; Suyarov, U. S. pp 43-46 of Teoriya Otnositel'nosti i Gravitatsiya. Stanyukovich, K. P. (ed.). Moscow; Izdatel'stvo Nauka Glavnaya Redaktsiya Vostochnoi Literatury (1974). (In Russian)

From meeting of Society of Naturalists on theory of relativity and gravitation; Moscow, USSR (26 Apr 1974). See CONF-740493–.

It is shown that if the condition $\delta L + \Sigma_{\mu=1}^{n} Q_\nu \delta q_\nu + \Sigma_{\nu,\mu} S_{\nu\mu} \dot{q}_\mu \delta q_\nu$ is fulfilled, then the Noether theorem can be used for the solution of the Chaplygin equation. This condition is realized and applied. (JSR)

7996 CONFORM-INVARIANT MODEL OF THE GRAVITATIONAL FIELD. Gonyaev, V. V. pp 53-56 of Teoriya Otnositel'nosti i Gravitatsiya. Stanyukovich, K. P. (ed.). Moscow; Izdatel'stvo Nauka Glavnaya Redaktsiya Vostochnoi Literatury (1974). (In Russian)

From meeting of Society of Naturalists on theory of relativity and gravitation; Moscow, USSR (26 Apr 1974). See CONF-740493–.

The equations for a conform-invariant model of the gravitational field are formulated. With the model derived a conform-invariant description of the interaction of the field with any material is possible. (JSR)

7997 NON-STEADY SOLUTION OF THE EINSTEIN EQUATION AND OF MASSLESS SCALAR FIELDS IN A CONFORMALLY TWO-DIMENSIONAL SPACE. Shikin, G. N. pp 63-65 of Teoriya Otnositel'nosti i Gravitatsiya. Stanyukovich, K. P. (ed.). Moscow; Izdatel'stvo Nauka Glavnaya Redaktsiya Vostochnoi Literatury (1974). (In Russian)

From meeting of Society of Naturalists on theory of relativity and graviation; Moscow, USSR (26 Apr 1974). See CONF-740493–.

Precise solutions of the system of Einstein equations and massless scalar fields in a formally two-dimensional space were obtained in the form of simple traveling longitudinal waves. (JSR)

7998 HARMONIC DIFFEOMORPHISM AND UNICITY. Choquet–Bruhat, Y.; Gilain, C. (Paris-6 Univ., 75 (France)). Compt. Rend., Ser. A, B; 279: No. 23, 827–830(2 Dec 1974). (In French).

The unicity theorem is established for Einstein equations using a harmonic diffeomorphism. (FR)

7999 COMPACT TOPOLOGIES ON MINKOWSKI SPACE. Nanda, S.; Panda, H. K. (Regional Engineering Coll., Rourkela, India). Int. J. Theor. Phys.; 10: No. 3, 159–163(Aug 1974).

Minkowski space can be given topologies which are compact and which have, as their homeomorphism group, the inhomogeneous Lorentz group together with dilatations. (auth)

8000 HOMOMORPHISM THEOREM FOR THE POINCARE GROUP. Sen, D. K. (Toronto Univ.). Int. J. Theor. Phys.; 10: No. 3, 153–157(Aug 1974).

Jordan demonstrated that the group of homogeneous transformations of degree one in $\mathfrak{R}^5$ is homomorphic to the symmetry group of the Einstein–Maxwell equations in vacuum. It is shown that the Jordan homomorphism theorem is also applicable to the inhomogeneous general linear group. Consequently, the Poincaré group is homomorphic to the group of homogeneous transformations of degree one in a five-dimensional space. (auth)

8001 SOME ZERO REST MASS TEST FIELDS IN GENERAL RELATIVITY. Held, A.; Voorhees, B. H. (Univ., Bern). Int. J. Theor. Phys.; 10: No. 3, 179–187(Aug 1974).

Zero rest mass test fields of pure algebraic type are defined and studied via the newly developed GHP formalism. The field equations are written explicitly and an immediate generalization of Robinson's theorem (J. Math. Phys.; 2: 290 (1961)) is obtained. The form for the general zero rest mass test field of pure type is determined in terms of the tetrad components of the background Weyl spinor and an additional gauge dependent function which can be thought of as representing a test neutrino field. (auth)

8002 "HYPERSPACE" (THE COBORDISM THEORY OF SPACE–TIME). Whiston, G. S. (Univ. of Durham, Eng.). Int. J. Theor. Phys.; 11: No. 5, 285–288(Dec 1974).

It is demonstrated that a compact space and time-orientable space-time is cobordant in the unoriented sense, that is, bounds a compact five-manifold. The bounding property is a direct consequence of the triviality of the Euler number. (auth)

8003 WEAK-FIELD APPROXIMATION IN THE TWO-BODY PROBLEM OF GENERAL RELATIVITY. Zhdanov, V. I. (Inst. of Theoretica Physics, Kiev). Int. J. Theor. Phys.; 11: No. 4, 249–259(Nov 1974).

The two-body problem of general relativity is considered taking into account the retardation of interactions. The equations of motion are shown to be simplified, and this enables one to neglect the effects of heredity. The problem of validity of the approximations involved is considered in the extended-particle formalism. It is shown that under the correct treatment the self-interaction terms do not lead to unphysical solutions. (auth)

8004 DINGLE'S CONTROVERSY ABOUT THE CLOCK PARADOX AND THE EVOLUTION OF IDEAS IN SCIENCE. Sachs, M. (State Univ. of New York, Buffalo). Int. J. Theor. Phys.; 10: No. 5, 321–331(Sep 1974).

Reference is made to the book Science at the Crossroads (1972) by H. Dingle, in which he reviewed his extended controversy on the clock paradox of special relativity theory. One does not agree with Dingle's conclusion that relativity theory entails a paradox because he does not accept Dingle's interpretation of the Lorentz transformations as consistent with the theory of relativity. However, it is suggested that attention should be paid to Dingle's comments on the present-day attitudes of dogmatism and anti-rationalism that he has experienced from the physics community, following the controversy. (UK)

8005 FLUX OF MOMENTUM OF N-BODIES SYSTEM BY GRAVITATIONAL WAVES. Dionysiou, D. D. (Univ. of Athens). Int. J. Theor. Phys.; 10: No. 5, 355–362(Sep 1974).

The energy and angular momentum carried by gravitational waves of an N-body system were extensively studied. The linear momentum, within general relativity, is investigated by studying waves emitted from a source consisting of N-particles moving under their own gravitation. (auth)

8006 ZERO VALUE OF THE SCHWARZSCHILD MASS FOR AN ASYMPTOTICALLY EUCLIDIAN SYSTEM OF GRAVITATIONAL WAVES. Folomeshkin, V. N. (Inst. of Physics of High Energy, Serpukhov, USSR). Int. J. Theor. Phys.; 11: No. 6, 387–394 (Dec 1974).

A class of the asymptotically Euclidian space-times is shown to exist for which the Schwarzschild mass is equal to zero. The coordinate atlases of these space-times satisfy two additional conditions: $\partial_k(-gg^{ik}) = 0$ and $\Gamma^0_{ik}\partial_0 g^{ik} - \Gamma^k_{ik}\partial_0 g^{0i} = 0$. In a T-orthogonal metric $ds^2 = g_{00}dt^2 - g_{\alpha\beta}dx^\alpha dx^\beta$ these conditions take a simple form: $\partial_\delta(\det g_{\alpha\beta}) = 0$ and $(\partial_0 g^{\alpha\beta})(\partial_0 g_{\alpha\beta}) = 0$. (auth)

8007 GRAVITATIONAL FIELD OF NULLICLE. Hogan, P. A. (Univ. of Texas, Austin). Int. J. Theor. Phys.; 11: No. 6, 419–424(Dec 1974).

A natural generalization of the Schwarzschild solution is presented. It is an exact solution of the vacuum Einstein field equations and is interpreted as the gravitational field of a nullicle (null-particle). (auth)

8008 ZERO VALUE OF THE SCHWARZSCHILDIAN MASS OF ASYMPTOTICALLY EUCLIDIAN TIME-SYMMETRICAL GRAVITATIONAL WAVES. Folomeshkin, V. N. (Inst. of Physics of High Energy, Serpukhov, USSR). Int. J. Theor. Phys.; 10: No. 3, 145-151(Aug 1974).

It is shown that a coordinate system with simple coordinate conditions can be chosen such that one can explicitly see that the Schwarzschildian mass of an asymptotically Euclidian time-symmetrical system of gravitational waves is equal to zero. It is explicitly seen in the coordinate system with coordinate conditions $\delta_i(-gg^{ik}) = 0$ and in the set of coordinate systems with the coordinate condition $\delta_i(-gg^{ki}) = 0$. In this set of coordinate systems one of the field equations can be written in the form $-8\pi\sqrt{(-g)}(T^\alpha_0 - \frac{1}{2}T) = \delta_\alpha L^{\alpha\alpha}_0$ where $L^{kn}_l = \frac{1}{2}\sqrt{(-g)}(g^{mn}\Gamma^k_{lm} - g^{km}\Gamma^n_{lm})$, $\alpha = 1, 2, 3$. From this equation it follows that $m = 2\int (T^\alpha_0 - \frac{1}{2}T)\sqrt{(-g)}\, dV$, and $m = 0$ at $T^k_l = 0$. (auth)

8009 SPONTANEOUSLY BROKEN SCALE INVARIANCE AND GRAVITATION. Fujii, Y. (Tokyo Univ.). Gen. Relativity Gravitation; 6: No. 1, 29-34(Feb 1975).

From 7th international conference on gravitation and relativity; Tel-Aviv, Israel (Jun 1974).

It is proposed to combine the scalar-tensor theory of gravitation with the hypothesis of "spontaneously broken scale invariance," which has been developed in quantum field theory and seems to give a better understanding of the origin of the masses of elementary particles. The general theoretical background of this approach is reviewed. In the model theory discussed, it is predicted that the Newtonian gravitational potential acquires an anomalous part with a force-range typically of the order of 10^3 cm. The experimental consequences are also discussed. (auth)

8010 RADIATION AS A SOURCE OF GRAVITATION. Bondi, H. (Ministry of Defense, London). Nature (London); 253: No. 5491, 414-415(6 Feb 1975).

A mathematical treatment is present in terms of general relativity, and results are given for a few steady state cases. (UK)

8011 NEUTRINO STRUCTURE OF THE ETHER. Ruderfer, M. (Dimensions, Inc., Hempstead, NY). Lett. Nuovo Dim.; 13: No. 1, 9-13(3 May 1975).

The properties of Lorentz ether discussed include the neutrino sea and its velocity spectrum and the ability to transmit light and gravitational forces. (JFP)

8012 GRAVITATIONAL THEORY OF KAR. Cavalleri, G. (CISE, Milan). Lett. Nuovo Cim.; 12: No. 6, 180-182(8 Feb 1975).

Various reasons for disagreeing with the gravitation theory of Kar, who suggested that the gravitational attraction may be due to chains of annihilated electron-positrons which while passing through nucleons can experience some obstruction, are discussed. (JFP)

8013 INTERNAL EXCITATIONS OF CHARGED SELF-GRAVITATING MATTER. Kumar, N. (Univ., Liege); Chhajlany, S. C. Lett. Nuovo Cim.; 12: No. 17, 683-686(26 Apr 1975).

The internal excitations of a charged self-gravitating external object of variable (r-dependent mass) are considered, using a previous expression for the instantaneous rest mass of such an object. It is found that the resulting energy spectrum has certain remarkable features, which have physical significance. It is concluded that the work suggests the relevance of gravity at small distances. The Dirac general line of argument is used. (JFP)

REACTOR TECHNOLOGY AND REGULATION

Refer also to abstracts 6388 and 6389.

8014 (ERDA-29-74) OPERATING HISTORY OF U. S. NUCLEAR POWER REACTORS. (Energy Research and Development Administration, Washington, D. C. (USA). Div. of Reactor Research and Development). 1974. 89p. Dep. NTIS $5.45.

The operating history of U. S. nuclear power plants through December 31, 1974, has been collected. Included are those nuclear reactor facilities which produce electricity, even if in token amounts, or which are part of a development program concerned with the generation of electricity through the use of a nuclear reactor as a heat source. The information is based on data furnished by facility operators. The charts are plotted in terms of cumulative thermal energy as a function of time. Since only those shutdowns of five days or more are shown, the charts do not give a detailed history of plant operation. They do, however, give an overview of the operating history of a variety of developmental and experimental nuclear power reactors. The data show the yearly gross generation of electricity for each U. S. nuclear plant and, for civilian power plants, information on reactor availability and plant capacity factor. (auth)

8015 ENERGY, ENVIRONMENT, AND ENGINEERING. Proceedings of Frontiers of Power Technology, Stillwater, Oklahoma, October 10–11, 1973. Stillwater, OK; Oklahoma State University (1973). vp. (CONF-731096-).

Separate abstracts were prepared for 4 of the 13 papers included. The remaining papers were outside the scope of NSA. (JWR)

For abstracts of individual papers see: 6471, 8037, 8079, and 8366.

Power Reactors, Non-Breeding, BWR-Type

Refer also to abstracts 6342, 7183, 8219, 8224, 8231, 8235, 8249, 8251, 8260, 8289, 8303, 8388–8390, 8393, 8395, 8396, 8400, 8407, and 8408.

8016 (CONF-750413-P1, pp I.25-I.37) REPLACEMENT OF REFLECTORS BY ALBEDO TYPE BOUNDARY CONDITIONS. Kalambokas, P. C.; Henry, A. F. (Massachusetts Inst. of Tech., Cambridge). 1975.

From ANS computational methods in nuclear energy; Charleston, South Carolina, USA (15 Apr 1975).

In proceedings of the conference on computational methods in nuclear engineering. Vol. I. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.; Energy Research and Development Administration, Aiken, S. C. (USA). Savannah River Operations Office).

The procedure of representing the effect of a reflector on the behavior of a reactor by using a homogeneous boundary condition at the core-reflector interface has been examined for two-group, two dimensional situations representative of a light water moderated power reactor. In addition the scheme has been extended to the time dependent case. A matrix relating the net neutron currents normal to the surface of the core to the group fluxes on that surface is found. The elements of this matrix are algebraic formulas involving the group cross sections and thickness of the reflector and depending on the instantaneous transverse bucklings and logarithmic time derivatives of the group currents at the core-reflector interface. Comparisons for two dimensional (XY) static problems between flux shapes and eigenvalues determined using these boundary conditions and the analogous quantities determined with the reflector represented explicitly yield agreement of a few tenths of a percent in eigenvalue and a few percent in point flux values. Problem costs are reduced about forty percent. Similar comparisons for one dimensional time-dependent cases are also very encouraging. (6 references) (auth)

8017 (CONF-750413-P1, pp I.83-I.98) NEW COARSE MESH, MODIFIED ONE-GROUP DIFFUSION CALCULATION SCHEME FOR MULTIDIMENSIONAL BWR CORE ANALYSIS. Tsuiki, M.; Aoki, K.; Yoshimura, S. (NAIG Nuclear Research Lab., Kawasaki, Japan). 1975.

From ANS computational methods in nuclear energy; Charleston, South Carolina, USA (15 Apr 1975).

In proceedings of the conference on computational methods in nuclear engineering. Vol. I. (Du Pont de Nemours (E. I.) and Co., Ainen, S. C. (USA). Savannah River Lab.; Energy Research and Development Administration, Aiken, S. C. (USA). Savannah River Operations Office).

To improve the accuracy of the BWR core simulator, a new coarse mesh equation and a new modified one-group diffusion scheme were devised independently and their efficiencies were confirmed through comparisons with ordinary few-group fine mesh calculations. These two methods were then combined to establish an effective calculational scheme for multidimensional BWR core analysis. To confirm the effectiveness of the new scheme, two- and three-dimensional test codes were developed and comparisons were made of accuracy and run time with the conventional few-group fine mesh calculations. (6 references) (auth)

8018 (CONF-750413-P2, pp V.27–V.41) NEPTUNE: A MODULAR SCHEME FOR THE CALCULATION OF LIGHT WATER REACTORS. Kavenoky, A. (CEN de Saclay, Gif-sur-Yvette, France). 1975.

From ANS computational methods in nuclear energy; Charleston, South Carolina, USA (15 Apr 1975).

In proceedings of the conference on computational methods in nuclear engineering. Vol. II. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.; Energy Research and Development Administration, Aiken, S. C. (USA). Savannah River Operations Office).

The NEPTUNE modular scheme has been developed to provide the physicist and the design engineer with a single system of codes for the calculation of light water reactors. The APOLLO code is included in NEPTUNE for the multigroup transport treatment of cells, groups of cells and complete fuel assemblies; few groups cross section libraries are automatically transmitted to the reactor multidimensional diffusion modules. In the reactor phase, 1D and 2D diffusion calculations can be performed by use of the finite difference method; 2D and 3D calculations are done respectively by the BILAN and TRIDENT modules using the finite element method. For the depletion calculation coarse and refined computations are offered. NEPTUNE is characterized by two special features for the data processing: the OTOMAT system which provides a virtual memory simulation and the Intervention Monitor which allow to disconnect the computation modules and the control modules. 10 references. (auth)

8019 (HEDL-TME-73-75) HEAVY SECTION STEEL TECHNOLOGY PROGRAM. Technical Report No. 31. The Irradiation and Temperature Dependence of Tensile and Fracture Properties of ASTM A533, Grade B, Class 1 Steel Plate and Weldment. Williams, J. A. (Hanford Engineering Development Lab., Richland, Wash. (USA)). Aug 1973. Contract AT(45-1)-2170. 56p. Dep. NTIS $5.45.

Tensile and fracture toughness behavior of irradiated and unirradiated ASTM A533, Grade B, Class 1 steel and submerged arc weld from twelve inch thick plates were investigated. Specimen irradiations were conducted at 510°F to 540°F to a maximum fluence of 0.5, 2, 4, 6 and 8 x 10^{19} n/cm^2 (E greater than 1 MeV). Test temperatures ranged from –300°F to 550°F. Irradiation damage annealing thresholds were determined by tensile yield strength studies. Irradiation was found to effect both tensile and fracture toughness of all levels of fluence and no saturation of the effect of fluence on properties was evident. Yield strength was more sensitive to irradiation than was ultimate strength and tensile ductility generally decreased with irradiation. Irradiation primarily affected the fracture toughness by increasing the temperature at which the transition from low to high toughness occurred. The toughness transition of weld material was observed to be more sensitive to irradiation than was plate material. Postirradiation annealing of A533-B plate at 625°F produced up to 70 percent recovery of yield strength, suggesting that significant irradiation embrittlement recovery could be accomplished for a similar annealing treatment. 31 references. (auth)

8020 (IAE-2345) INVESTIGATIONS OF THE THERMOHYDRAULIC CHARACTERISTICS OF MODELS OF REACTOR FUEL ASSEMBLIES AT KURCHATOV ATOMIC ENERGY INSTITUTE. Osmachkin, V. S. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1974. 36p. (In Russian). Dep. NTIS (US Sales Only) $5.00.

Descriptions are given of the thermophysical testing unit of the Kurchatov Atomic Energy Institute, the construction of experimental sections, and methods of determining hydraulic characteristics of rod bundles and critical heat fluxes on full scale models of reactor fuel assemblies cooled by water under pressure and by boiling water. A discussion is presented of a method of calculating critical heat fluxes in heat-emitting fuel rods. A look is taken at a method of taking into account the effect of radial and axial inhomogeneity of heat emission on conditions for the occurrence of a critical heat flux (burnout). (tr-auth)

8021 (NEDO-20134) RESPONSES TO AEC QUESTIONS REGARDING NEDM-10735 (ORIGINALLY NEDM-10735, SUPPLEMENT 1). (General Electric Co., San Jose, Calif. (USA). Nuclear Fuels Dept.). Oct 1973. vp. General Electric Co., San Jose, CA.

Responses to AEC questions concerning fuel densification effects in General Electric BWR's are presented. (JWR)

8022 (NEDO-20135) RESPONSES TO AEC QUESTIONS REGARDING NEDM-10735 (ORIGINALLY NEDM-10735, SUPPLEMENT 2). (General Electric Co., San Jose, Calif. (USA). Nuclear Fuels Dept.). Oct 1973. vp. General Electric Co., San Jose, CA.

Responses to AEC questions concerning fuel densification effects in General Electric BWR's are presented. (JWR)

8023 (NEDO-20136) RESPONSES TO AEC QUESTIONS REGARDING NEDM-10735 (ORIGINALLY NEDM-10735, SUPPLEMENT 3). (General Electric Co., San Jose, Calif. (USA). Nuclear Fuels Dept.). Oct 1973. 20p. General Electric Co., San Jose, CA.

Responses to AEC questions concerning fuel densification effects in General Electric BWR's are presented. (JWR)

8024 (NEDO-20138) RESPONSES TO AEC QUESTIONS REGARDING NEDM-10735 (ORIGINALLY NEDM-10735, SUPPLEMENT 5). Licensing Topical Report. (General Electric Co., San Jose, Calif. (USA). Atomic Power Equipment Dept.). Oct 1973. 80p. General Electric Co., San Jose, CA.

Responses to AEC questions concerning fuel densification effects in General Electric BWR's are presented. (JWR)

8025 (NP-20300) SAFETY EVALUATION OF THE EMERGENCY ELECTRICAL SYSTEM OF UNIT NO. 1 OF THE LAGUNA VERDE NUCLEAR POWER PLANT. Contreras, L. S. (Guadalajara Univ. (Mexico). Facultad de Ingenieria). 1974. 112p. (In Spanish). Dep. NTIS (US Sales Only) $8.75.

Thesis.

8026 (NP-20380, pp 1.1–1.41) CONVERTER REACTORS. Keyes, G. B. (Westinghouse Electric Corp., Pittsburgh). 1974.

In status report: energy resources and technology.

The historical background to the U. S. nuclear power program is reviewed. A description of current light water reactor and high temperature gas cooled reactor systems is presented. The nuclear fuel cycle for converter reactors is examined. An inventory of nuclear power plant orders is presented and predictions of future growth are discussed. (JWR)

8027 (PNCT-831-74-02) TOKAI WORKS SEMIANNUAL PROGRESS REPORT: JANUARY–JUNE 1974. (Power Reactor and Nuclear Fuel Development Corp., Tokai, Ibaraki (Japan). Tokai Works). Dec 1974. 158p. Dep. NTIS (US Sales Only) $11.00.

Information is presented concerning the performance analysis of PuO_2–UO_2 fuel in light-water reactors, test fabrication of JOYO Reactor fuel pins, test fabrication of PuO_2–UO_2 pellets for light-water reactors, performance testing of stainless steel-316 cladding for LMFBR fuel pins, and solution treatment of stainless steel-316. (DCC)

Power Reactors, Non-Breeding, PWR-Type

Refer also to abstracts 6604, 8016, 8018–8020, 8026, 8027, 8202, 8203, 8205–8207, 8211–8213, 8215, 8219, 8235, 8249–8252, 8303, 8372, 8389, 8390, 8392, 8394, and 8399.

8028 (BAW-10097(Rev.1)) MARK C (17 x 17) FUEL ASSEMBLY. Research and Development. Revision 1. Stoudt, R. H.; Kern, R. C.; Walton, L. A. (Babcock and Wilcox Co., Lynchburg, Va. (USA). Nuclear Power Generation Div.). Apr 1975. 14p. Babcock and Wilcox, Lynchburg, VA.

The research and development programs related to the B and W Mark C (17 x 17) fuel assembly are described. The programs described herein are designed to provide data for analytical models, confirm predictions, and verify the adequacy of the design. A general description of the Mark C assembly is presented along with comparisons to the Mark B (15 x 15) fuel assembly. The report is organized in three main test areas: mechanical and hydraulic; critical heat flux; and rod swelling and burst. The test program scopes and objectives are discussed along with the test methods. (auth)

8029 (CEA-N-1725) DEVELOPMENT OF METHODS FOR CALCULATING THE POISONS BURNABLE IN NATURAL WATER REACTORS. Mondot, J. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Div. d'Etude et de Developpement des Reacteurs). Jul 1974. 139p. (In French). Dep. NTIS (US Sales Only) $10.00.

Thesis.

A calculational method for reactor lattices containing self-shielded burnable poisons is presented. The calculation is divided in two steps. A transport calculation with a multicell model is performed using APOLLO (transport code with 99 energy groups and first collision probabilities). Some remarks are made on the multicell formalism used by this code. A method to determine the effective macroscopic constants of poison media is derived in order to obtain a good estimation of the poison worth with a diffusion calculation. Secondly, a two dimensional diffusion calculation with four energy groups is made either for the whole core of any desired part of it. A comparison between these calculations and results from critical experiments obtained by Babcock and Wilcox, shows good agreement regarding reactivity, power distributions and various poisons worths. Some results of depletion calculations are also presented and an estimation of the influence of spatial non-uniform depletion of poison is given. (13 references) (auth)

8030 (CENPD-145) INCA: METHOD OF ANALYZING IN-CORE DETECTOR DATA IN POWER REACTORS. Ober, T. G.; Terney, W. B.; Marks, G. H. (Combustion Engineering, Inc., Windsor, Conn. (USA)). Apr 1975. 199p. Combustion Engineering, Inc., Windsor, CT 06095.

A method (INCA) is described by which signals from fixed in-core detectors are related to estimates of the three dimensional power distribution in an operating reactor core and to the maximum linear heat rate in the core. A description of the large library of data accompanying the method is provided. A detailed examination of the analytical verifications performed using the method is presented, and a summary of the uncertainty associated with the method is given. The uncertainty assigned to the maximum linear heat rate inferred by the method from operating reactor data is found to be 5.8 percent at a 95/95 confidence level. (auth)

8031 (CENPD-162) C-E CRITICAL HEAT FLUX. Critical Heat Flux Correlation for C-E Fuel Assemblies With Standard Spacer Grids. Part 1. Uniform Axial Power Distribution. (Combustion Engineering, Inc., Windsor, Conn. (USA)). Apr 1975. 155p. Combustion Engineering, Inc., Windsor, CT 06095.

The CE-1 CHF correlation and supporting information are presented. The CE-1 correlation was developed for the prediction of Critical Heat Flux (CHF) in 14 x 14 and 16 x 16 array C-E fuel assemblies with C-E standard spacer grids for the case of a uniform axial power distribution. The correlation, the source data, and a description of the test facility and test procedures used to obtain the data are presented. Comparisons are presented of the CHF predictions of the CE-1 correlation with results obtained from other CHF tests and correlations. The correlation predicts CHF for the 731 source data with a mean and standard deviation of the ratio of measured and predicted CHF of 0.99983 and 6.757 percent, respectively. Results are presented which show that the CE-1 correlation is supported by relevant rod bundle CHF data available in the literature, by data obtained for C-E at a second test facility and by data obtained for C-E using a rod bundle with a heated flow shroud. Application of the CE-1 correlation for design thermal margin calculations is discussed. It is concluded that use of the CE-1 correlation with a value of 1.13 for the minimum ratio of predicted CHF and actual heat flux (CHFR or DNBR) provides a 95 percent probability at 95 percent confidence level of not experiencing CHF on a hot rod, as determined by evaluation of the CE-1 source data for a uniform axial power distribution. Determination of the appropriate DNBR for use in PWR design thermal margin calculations will be done including data and methodology for nonuniform axial power shapes. (auth)

8032 (CONF-750413-P1, pp I.99-I.115) SOLUTION OF THE MULTIDIMENSIONAL NEUTRON DIFFUSION EQUATION BY NODAL EXPANSION. Bennewitz, F.; Finnemann, H.; Moldaschl, H. (Kraftwerk Union AG, Erlangen, Ger.). 1975.

From ANS computational methods in nuclear energy; Charleston, South Carolina, USA (15 Apr 1975).

In proceedings of the conference on computational methods in nuclear engineering. Vol. I. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.; Energy Research and Development Administration, Aiken, S. C. (USA). Savannah River Operations Office).

The multidimensional neutron diffusion equation is solved by a combination of nodal methods with weighted residual techniques. This improved nodal technique relies on 1-D diffusion calculations for determining the spatial coupling coefficients. The 1-D diffusion equations are solved by polynomial expansion. For this reason, the method has been called Nodal-Expansion-Method (NEM). Results

of calculations for static benchmark problems and installed PWR's are discussed which demonstrate the accuracy and computational efficiency of the proposed method. (16 references) (auth)

8033 (CONF-750413-P2, pp VI.69-VI.83) MULTIDIMENSIONAL SPACE-TIME KINETICS CODE FOR PWR TRANSIENTS. Rohan, P. E.; Kang, C. M.; Shober, R. A.; Wagner, S. G. (Combustion Engineering, Inc., Windsor, CT). 1975.

From ANS computational methods in nuclear energy; Charleston, South Carolina, USA (15 Apr 1975).

In Proceedings of the conference on computational methods in nuclear engineering. Vol. II. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.; Energy Research and Development Administration, Aiken, S. C. (USA). Savannah River Operations Office).

The neutronic, thermal-hydraulic and cross section models incorporated in the multi-dimensional space-time kinetics code, HERMITE, are described. The neutron diffusion equation, in the weak form, is solved by a finite element method using linear basis functions in both space and time. A closed channel thermal-hydraulic model is used. The continuity and conservation of energy equations are solved for each flow channel which is typically a single assembly. A multi-region fuel pin consisting of a cylindrical UO_2 pellet, a gas gap and Zircaloy cladding is modeled in the code. The heat conduction equation for the fuel pin is solved by a conventional finite difference method. Numerical results for both a steady-state and transient problem are presented. Static calculations are compared against PDQ. For the identical mesh the finite element method is more accurate than PDQ for power distribution calculations, although running times are longer. Reactivity worths of control rods compare favorably for the two codes. 8 references. (auth)

8034 (DLCS-5000374) SHIPPINGPORT ATOMIC POWER STATION. Quarterly Operating Report, Third Quarter 1974. (Duquesne Light Co., Shippingport, Pa. (USA)). 1974. Contract AT(11-1)-292. 14p. Dep. NTIS $4.00.

During the third quarter of 1974, the Shippingport Atomic Power Station remained shutdown for main unit turbine repairs and preparation for refueling. The 1A Reactor coolant Loop continued to remain isolated from the reactor. The BD Core Removal Cooling System remained on the 1B Reactor Coolant Loop except during a brief period on July 29 when maintenance was performed on the Core Removal Cooling Pump. The average coolant temperature was maintained at approximately 123°F until July 29 when the temperature was reduced to 85°F ± ⅝°F range to support reactor vessel external equipment removal. The container air treatment was shutdown with the butterfly valves closed on August 7 for repairs. The system was returned to normal service on August 10. The 1A and 1B Canal Water Demineralizers were flushed on July 23. The 1A Canal Water Demineralizer was refilled and returned to service. On September 25, isolation of the control air line to the condensate make-up system neutralizing tank fail-open drain valve permitted approximately 340 and 460 lbs respectively of acid and caustic to be discharged without being neutralized to the Ohio River. Due to dilution prior to discharge and the slow discharge rate into the plant effluent channel sufficient mixing occurred to prevent danger to aquatic life in the river. Samples of the effluent channel and river after mixing indicated the discharge to be only slightly above pH discharge limits. During the period, 1,078 cubic feet of radioactive solid waste were shipped off-site for burial. These shipments contained 0.09 curie of radioactivity. (auth)

8035 (NEDO-20137) RESPONSES TO AEC QUESTIONS REGARDING NEDM-10735 (ORIGINALLY NEDM-10735, SUPPLEMENT 4). Licensing Topical Report. (General Electric Co., San Jose, Calif. (USA). Atomic Power Equipment Dept.). Oct 1973. 27p. General Electric Co., San Jose, CA.

Responses to AEC questions concerning fuel densification effects in General Electric BWR's are presented. (JWR)

8036 (RISO-M-1757) USERS MANUAL FOR THE PWR-PLASIM MODEL. la Cour Christensen, P. (Danish Atomic Energy Commission, Risoe. Research Establishment). Mar 1975. 124p. Dep. NTIS (US Sales Only) $8.75.

The implementation is presented of the PWR power plant model PWR-PLASIM, which was described in Riso Report No. 318. It should serve as a users' guide both for the operator running the model, and for the experienced simulation engineer modifying the input data or details of the model. (auth)

8037 ARKANSAS NUCLEAR ONE: A CASE STUDY. Cavanaugh, W. III. pp 10.1-10.26 of Energy, Environment, and Engineering. Stillwater, OK; Oklahoma State Univ. (1973).

From proceedings on frontiers of power technology; Stillwater, Oklahoma, USA (10 Oct 1973). See CONF-731096-.

Some of the problems involved in the construction and licensing of Arkansas Nuclear One, Units 1 and 2, are reviewed. These problems included scheduling, costs, environmental review, licensing, design, construction, staffing, and testing. (JWR)

8038 POWER INCREASE FOR ARDENNES NUCLEAR POWER PLANT. Moisdon, P.; Py, J. P. (Societe Franco-Americaine de Constructions Atomiques (FRAMATOME), 92- Courbevoie (France)). Ind. At. Spat.; 18: No. 4, 35-40(Jul 1974). (In French).

The consequences of the accident of January 1968 at the Ardennes station (jamming of a rod in the intermediate position) and the work carried out as a result on the thermal shield are described. The thermodynamic and neutronic characteristics of the boiler, steam generator, turbo-alternator group and secondary circuits when the power is increased beyond 950MW(t) are given. (FR)

Power Reactors, Non-Breeding, Graphite Moderated

Refer also to abstracts 8026, 8223, 8275, 8306, 8373, and 8397.

8039 (AERE-R-7890) DIFFUSION OF CAESIUM IN THE OUTER PYROLYTIC CARBON LAYER OF UNIRRADIATED COATED FUEL PARTICLES. Hooper, E. W. (UKAEA Research Group, Harwell. Atomic Energy Research Establishment). Feb 1975. 19p. Dep. NTIS (US Sales Only) $4.00. UK 50 pence.

The cesium concentration profiles established in the outer pyrocarbon layer of coated fuel particles when they are heated in cesium vapor have been determined by step-wise removal of the coating. A least squares fit of an error function to the concentration profile was used to obtain a value for the diffusion coefficient. Pyrocarbons derived from methane or propylene and having densities between 1.5 and 1.9 g cm^{-3} were examined. (auth)

8040 (CEA-CONF-2844) STUDY OF THE SHOCK BETWEEN TWO GRAPHITE BRICKS. Buland, P.; Goldstein, S. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service des Etudes Mecaniques et Thermiques). 1974. 39p. (In French). INIS.

From colloquium on the methods for shock study and simulation; Lyon, France (16 Oct 1974).

The results obtained for the impact of two graphite bricks from the core of a high temperature reactor are presented. The coefficient of restitution, contact duration, deformation at various points, and vibration frequencies of the bricks in their cross-section planes were determined by experiment and calculation with the PASTEL program based on the finite element method. The program is used in its dynamic plastic option. The consistency of the results obtained is good. (FR)

8041 (GA-A-13101) LOADING OF FUEL AND REFLECTOR ELEMENTS IN THE FORT ST. VRAIN INITIAL CORE (RESULTS OF START-UP TEST A-1). Marshall, A. C.; Brown, J. R. (Gulf General Atomic Co., San Diego, Calif. (USA)). 1 Nov 1974. Contract AT(04-3)-633. 85p. Dep. NTIS $5.45.

A description is given of the experimental equipment and techniques used in the fuel and reflector loading. The analysis methods are described and test data are compared with predicted results. (DG)

8042 (GA-A-13156) FORT ST. VRAIN HOT FUNCTIONAL TEST RESULTS. Phelps, R. D. (Gulf General Atomic Co., San Diego, Calif. (USA)). 30 Dec 1974. Contract AT(04-3)-633. 30p. Dep. NTIS $4.00.

A description is given of Fort St. Vrain hot functional tests performed to evaluate the initial nonnuclear performance of the primary coolant system and the associated effects on the various internal components of the reactor vessel and primary coolant system. The components included the twelve steam generator modules, the four helium circulators, the PCRV thermal barrier and liner coolant system, the helium purification system, and the primary and secondary closures at each of the PCRV penetrations. Additional objectives included analysis of the parallel operation of the four helium circulators and the performance of several circulator start/stop transients under various conditions of primary coolant temperature and pressure. Vibration and acoustical phenomena within the vessel were measured, recorded, and compared to theoretical analyses; a verification of reverse flow in the shutdown loop steam generator during one loop operation was performed; the PCRV was again observed for its structural response to internal pressure; and comparisons were made relative to data recorded during the initial pressure test completed in July 1971. (auth)

8043 (GA-A-13176) NEUTRON FLUX DISTRIBUTION MEASUREMENT IN THE FORT ST. VRAIN INITIAL CORE (RESULTS

OF FORT ST. VRAIN START-UP TEST A-7). Marshall, A. C.; Brown, J. R. (Gulf General Atomic Co., San Diego, Calif. (USA)). 28 Feb 1975. Contract AT(04-3)-633. 84p. Dep. NTIS $5.45.

A description is given of a test to measure the axial flux distribution at several radial locations in the Fort St. Vrain core representing unrodded, rodded, and partially rodded regions. The measurements were intended to verify the calculational accuracy of the three-dimensional calculational model used to compute axial power distributions for the Fort St. Vrain core. (auth)

8044 (GA-A-13187) MAINTENANCE PLAN FOR THE GAS TURBINE HTGR POWER PLANT. Paget, J. A. (Gulf General Atomic Co., San Diego, Calif. (USA)). 31 Oct 1974. Contract AT(04-3)-167. 66p. Dep. NTIS $5.45.

The maintenance policies and requirements for the gas turbine--high-temperature gas-cooled reactor (GT-HTGR) power plant are discussed, and a tentative plan for complying with them is outlined. A brief summary is also given of relevant studies performed. The emphasis of the work is on providing for maintenance in design and layout. (auth)

8045 (GA-A-13196) APPROXIMATE CLOSED FORM SOLUTION TO THE FISSION PRODUCT DIFFUSION EQUATION IN ONE-DIMENSIONAL SLAB GEOMETRY. Smith, P. D. (General Atomic Co., San Diego, Calif. (USA)). 1 Nov 1974. Contract AT(04-3)-167. 70p. Dep. NTIS $5.45.

The derivation of a method to calculate the transient diffusion response in one-dimensional slab geometry is presented. The model developed is used to represent the fission-product diffusion process in the graphite moderator of an HTGR core. (JWR)

8046 (GA-A-13213) FISSION PRODUCT PLATEOUT CALCULATIONS FOR A GAS TURBINE HTGR. Chmielewski, R. D.; Hoot, C. G. (Gulf General Atomic Co., San Diego, Calif. (USA)). 1 Nov 1974. Contract AT(04-3)-167. 39p. Dep. NTIS $4.00.

Fission product plateout distributions for a direct cycle gas turbine high-temperature gas-cooled reactor (GT-HTGR) were calculated. This reactor concept uses a helium gas turbine power conversion system with all major components integrated into a prestressed concrete reactor vessel. The magnitude and distribution of fission product contaminants are important in the plant design phase for developing maintenance and handling procedures. Plateout distributions for ^{137}Cs, ^{140}La, Te, ^{90}Sr, /sup 110m/Ag, and ^{131}I have been calculated using a modified version of the computer code PAD. A major uncertainty is lack of adsorption data on the materials of interest. Perfect sink (i.e., no desorption) behavior was assumed for La, Te, Ag, and Sr. A sensitivity calculation was performed on the diffusion coefficient and mass transfer coefficients for Ag. Similarly, a sensitivity analysis for the adsorption isotherms for Cs and I is discussed. Recommendations are made for further work needed to determine design activity levels for the GT-HTGR system. (auth)

8047 (GA-A-13253) HTGR FUELS AND CORE DEVELOPMENT PROGRAM. Quarterly Progress Report for the Period Ending November 30, 1974. (General Atomic Co., San Diego, Calif. (USA)). 31 Jan 1975. Contract AT(04-3)-167. 159p. Dep. NTIS $7.60.

Progress is reported on studies of reactions between core materials and coolant impurities, basic fission product transport mechanisms, core graphite development and testing, the development and testing of recyclable fuel systems, and physics and fuel management studies. Materials studies include irradiation capsule tests of both fuel and graphite. Experimental procedures and results are discussed and, where appropriate, the data are presented in tables, graphs, and photographs. (auth)

8048 (GA-A-13285) PUBLIC SERVICE COMPANY OF COLORADO 330-MW(e) HIGH-TEMPERATURE GAS-COOLED REACTOR RESEARCH AND DEVELOPMENT PROGRAM. Quarterly Progress Report for the Period Ending December 31, 1974. (Gulf General Atomic Co., San Diego, Calif. (USA)). 31 Jan 1975. Contract AT(04-3)-633. 24p. Dep. NTIS $4.00.

The zero-power physics tests were concluded upon completion of startup tests to measure differential rod worths and reactivity coefficients. Good agreement was obtained between measured and calculated differential rod worths. Tentative segment 8 fuel loading requirements were determined. (DG)

8049 (GA-A-13353) HTGR FUELS AND CORE DEVELOPMENT PROGRAM. Quarterly Progress Report for the Period Ending February 28, 1975. (General Atomic Co., San Diego, Calif. (USA)). 31 Mar 1975. Contract AT(04-3)-167. 112p. Dep. NTIS $5.45.

Progress is reported in studies of reactions between core materials and coolant impurities, basic fission product transport mechanisms, core graphite development and testing, the development and testing of recyclable fuel systems, and physics and fuel management studies. Materials studies include irradiation capsule tests of both fuel and graphite. Experimental procedures and results are discussed, and data are presented. (auth)

8050 (JAERI-M-5876) IRRADIATION TESTS OF COATED UC_2 PARTICLES IN WATER-COOLED IRRADIATION LOOP FACILITIES (EFTL-2 AND HWL-1) INSTALLED TO JRR-2. Iwamoto, K.; Kikuchi, A.; Hayashi, T.; Fukuda, K.; Kashimura, S. (Japan Atomic Energy Research Inst., Tokyo). Oct 1974. 34p. (In Japanese). INIS.

Irradiation tests of the coated UC_2 particles have been performed at temperatures up to 1400°C and burn-up up to about 100 MWD/T in EFTL-2 and HWL-1 water-cooled loop facilities in JRR-2. The first experience of this kind in JAERI, the tests showed that the thermal stability of the coating layers, the SiC layer especially, needs extensive improvement; deterioration of the coating layers is less in the TRISO-II than in the TRISO-I type. (auth)

8051 (UNI-SA-9) ENGINEERED MAINTENANCE APPROACH TO IMPROVED NUCLEAR PLANT AVAILABILITY. Robinson, R. K.; Stringer, J. T.; Faught, M. L. (United Nuclear Industries, Inc., Richland, Wash. (USA)). Mar 1975. Contract AT(45-1)-1857. 18p. (CONF-750416-2). Dep. NTIS $4.00.

From IAEA symposium on reliability of nuclear power plants; Innsbruck, Austria (14 Apr 1975).

A description is given of the planning, implementation, and results of the maintenance and surveillance program employed at the Hanford N Reactor. (DG)

8052 ANALYSIS OF THE FEASIBILITY OF A BRAYTON-CYCLE HTGR-POWERED COMBINED THERMAL-ELECTRICAL UTILITY SYSTEM. Von Nida, A.; Golay, M. W. (Massachusetts Inst. of Tech., Cambridge). pp 703-715 of Environmental Effects of Cooling Systems at Nuclear Power Plants. Vienna; International Atomic Energy Agency (Feb 1975).

From symposium on the physical and biological effects on the environment of cooling systems and thermal discharges at nuclear power stations; Oslo, Norway (26 Aug 1974). See STI/PUB-378; CONF-740820-.

A study has been performed of the feasibility of supplying the thermal and electrical energy requirements of a large (50,000 population) military post. A military installation was studied because there is no alternative electrical and thermal load data base for equivalent sized cities in the United States of America. However, the results are applicable to civilian situations since the available civilian and military load schedules and magnitudes are similar. The system is powered by a 100-MW(e) General Atomic design high-temperature gas-cooled reactor (HTGR) Brayton-cycle station, which rejects heat (T = 400°F) to the high-temperature water thermal utility system. Projecting current demand schedules and growth-rates to 1985 the required station capacities are 100 MW(e) and 200 MW(th), for average annual demands of 57 MW(e) and 170 MW(th) (of which 60% would be supplied by the thermal utility system). The combined utility system is marginally justified in cases where fuel-oil prices exceed $0.96 million Btu ($5.58 barrels oil). Improvements in the combined utility concept appear to be possible using available technology in such areas as energy storage, plant product-mix variation, demand modification, and station control. (auth)

8053 DEVELOPMENT OF REACTORS FOR HIGH-TEMPERATURE PROCESSES. Shepherd, L. R. Com. Naz. Energ. Nucl., Not.; 21: No. 2, 35-46(Feb 1975). (In Italian).

The possibilities for the development of reactors for use in high-temperature heat processes are considered. Although at present only the high-temperature, gas-cooled reactors appear to be suitable for this purpose, they will have to be considerably perfected and undergo major modifications before they can be used to generate high-temperature process heat. In view of the differences in use, they will have to be designed in different ways from power-generating HTGR's. The various problems to be tackled and solved before such systems can be adopted in process-heat applications are discussed. (auth)

Power Reactors, Non-Breeding, Otherwise Moderated

Refer also to abstracts 7168 and 8276.

8054 (JAERI-M-5885) VIBRATION OF ATR FUEL RODS. Okazaki, M.; Yamazaki, Y. (Japan Atomic Energy Research Inst., Tokyo). Nov 1974. 42p. (In Japanese). INIS.

Fuel rod vibration induced by coolant flow has been measured for the ATR Second Model Fuel Assembly equipped with ring-

type spacers in water and air-water two-phase flows. Instrumented dummy fuel rods were set at three representative positions in the array of the fuel assembly. Vibration characteristics were measured by semi-conductor strain gauge probes set at midpoints of the spans of 412 mm between the 4th and 5th spacer and of 824 mm between the 5th and 7th spacers taking off the 6th spacers from the bottom. In the power spectra of the rod vibration in water flows, main frequency components are 28 ~ 35 Hz and 97.5 Hz which correspond to the natural frequency of the whole assembly and the span between the spacers respectively. Power spectra of the frequency become flat with the increase of void fraction in case of the vibration in two-phase flow. The amplitude in two-phase flow was very large compared with water flow and was almost independent of water flow rate. The amplitude depends on void fraction, and the maximum is 0.5 mm at 0.5. The amplitude increases approximately proportionally to the square of the ratio of the span in water flow. While in two-phase flow, the amplitude increases nearly lineally with the ratio of the span. A continuous displacement of the rod neutral axis induced by fluid flow was very small compared with the result of the ATR First Model Fuel Assembly equipped with the twist type spacer. The difference of the results is due to the dissimilar rod support of the spacers used. (auth)

8055 (TRG-Report-2644(W)) EQUIPMENT FOR THE MEASUREMENT OF PIN PRESSURE AND FISSION GAS RELEASE IN DISCHARGED SGHWR FUEL PINS. O'Keefe, J. M. (UKAEA Reactor Group, Risley). Jan 1975. 12p. Dep. NTIS (US Sales Only) $4.00. HMSO 50 pence.

The equipment currently in use for measuring SGHWR fuel pin pressure, total gas volume, and pin void volume is described. The fuel pin is pierced with a device which adds only 2 ml to the pin void volume and the pressure is measured directly using a transducer attached to the puncture head. The total gas volume is measured by transferring all the gas to an out-of-cave apparatus. Samples are detached and analysed by mass spectrometry. The pin void volume is measured by backfilling with helium and measuring the volume of helium required. (auth)

8056 (ZJE-156) CHARGING MACHINE IN THE A-1 NUCLEAR POWER PLANT. Lavicka, J.; Korenek, J.; Hejman, J. (Skoda, Plzen (Czechoslovakia). Zavod Jaderne Elektrarny). 1974. 13p. Dep. NTIS (US Sales Only) $4.00.

Power Reactors, Breeding

Refer also to abstracts 6344, 6345, 6348, 6584, 7181, 8027, 8204, 8208, 8210, 8214, 8216, 8217, 8219, 8221, 8222, 8227, 8228, 8234, 8242–8248, 8305, 8376, and 8378.

8057 (ANL-8131) COBRA-3M: A DIGITAL COMPUTER CODE FOR ANALYZING THERMAL-HYDRAULIC BEHAVIOR IN PIN BUNDLES. Marr, W. W. (Argonne National Lab., Ill. (USA)). Mar 1975. Contract W-31-109-Eng-38. 54p. Dep. NTIS $5.45.

The COBRA-3M computer program is a modification of the thermal-hydraulic subchannel-analysis program COBRA-III. It includes detailed thermal models of fuel pin and duct wall. It is especially suitable for analyzing small pin bundles used in in-reactor or out-of-reactor experiments. (auth)

8058 (ANL-RDP-38) REACTOR DEVELOPMENT PROGRAM PROGRESS REPORT, MARCH 1975. (Argonne National Lab., Ill. (USA)). 28 Apr 1975. Contract W-31-109-Eng-38. vp. AT.

Progress is reported in the following areas: (1) EBR-2 operations and testing, (2) hot fuel examination facility, (3) fuels and materials development, (4) reactor physics, (5) reactor safety, and (6) GCFR studies. (JWR)

8059 (ANL-Trans-979) METALLURGICAL AND THERMODYNAMIC STUDY OF A CARBIDE FUEL CONTAINING INACTIVE FISSION PRODUCTS: IRRADIATED NUCLEAR FUEL "SIMULATION". Lorenzelli, N. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France)). Apr 1975. Translation of CEA-R-4465. 106p.

Thesis. Submitted to Paris Univ., Orsay, France.

This report brings up to date and complements the present literature knowledge on the various systems: uranium carbide–fission products (UC–F.P.), in particular UC–R.E. (rare earths), UC–Mo, UC–Ru, UC–Pd. It deals then with a "simulated" fuel, either partially or totally, i.e., without or with volatile F.P.; the fabrication process is described as well as the metallurgy and the thermodynamic properties of these materials, with emphasis on the effect of burnup on the variation of the parameter of the lattice and on the existence of the various phases to be formed. Three irradiation burnups were simulated: 70,000; 100,000; and 150,000 MWd/t (U + Pu). An analysis was performed on the chemical behavior of the fuel during irradiation, in presence of the stainless steel cladding. Several conclusions of technological interest could be derived, in particular, the noncarburizing character of the fission process. Finally, some irradiation results are discussed. (47 references) (auth)

8060 (CEA-CONF-2926) THERMAL DEFORMATION OF FAST REACTOR FUEL CLADS. Anselin, F.; Carteret, Y.; Bataller, S.; Clottes, G.; Mercier, C.; Dupouy, J. M. (CEA Centre d'Etudes Nucleaires de Saclay, 91 – Gif-sur-Yvette (France). Dept. de Technologie). 1974. 4p. (In French). INIS.

From European conference on irradiation behaviour of fuel cladding and core component materials; Karlsruhe, F. R. Germany (3 Dec 1974).

Important variations of the swelling in the thickness of fuel clads were observed as a function of the temperature gradient. Considerable internal stresses occur in the part of the cladding in which the important swelling variations develop. A change in the C content of the clad was also observed in these experiments. (FR)

8061 (COO-2250-3) LMFBR BLANKET PHYSICS PROJECT PROGRESS REPORT NO. 4. Driscoll, M. J.; Lanning, D. D.; Kaplan, I.; Supple, A. T. (eds.). (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Nuclear Engineering). 30 Jun 1973. Contract AT(11-1)-2250. 190p. (MITNE-149). Dep. NTIS $12.50.

During the period covered by the report, July 1, 1972, through June 30, 1973, work was devoted to completion of experimental measurements and data analysis on Blanket Mockup No. 3, a graphite-reflected blanket, and to initiation of experimental work on Blanket Mockup No. 4, a steel-reflected assembly designed to mock up a demonstration plant blanket. Work was also carried out on the analysis of a number of advanced blanket concepts, including the use of high-albedo reflectors, the use of thorium in place of uranium in the blanket region, and the "parfait" or completely internal blanket concept. Finally, methods development work was initiated to develop the capability for making gamma heating measurements in the blanket mockups. (auth)

8062 (EIR-276) BREEDING IN MOLTEN SALT REACTORS. Lectures at the University of Liege/Belgium, 15th May 1975. Taube, M. (Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen (Switzerland)). Apr 1975. 41p. Dep. NTIS (US Sales Only) $5.25.

Topics discussed include fissile and fertile nuclides, breeding ratio and breeding gain, doubling time, future energy development and uranium reserves, radioactive waste management, molten salt fuels, and fuel reprocessing. (JWR)

8063 (EURFNR-1182) FAST BREEDER PROJECT STATUS REPORT, 1974. Hueper, R. (comp.). (Kernforschungszentrum Karlsruhe (F. R. Germany)). May 1974. Translation of KFK-2003. 207p. Dep. NTIS $7.60.

Work performed under United States–Euratom Fast Reactor Exchange Program.

A compilation of the papers read at the Status Report of the Fast Breeder Project at the Karlsruhe Nuclear Research Center on March 26, 1974 is presented. The first papers present a general survey of the present state of research and development work performed by the German, Belgian, and Netherlands research centers on the SNR 300 Prototype Fast Breeder Reactor (Kalkar Nuclear Power Station), on the SNR follow-on program, alternative fuels and coolants and basic problems, on work performed by industry with respect to the licensing procedure and construction of the SNR 300, and on commissioning and the planned conversion of KNK, the Compact Sodium Cooled Nuclear Reactor. The detailed papers deal with results elaborated at the institutes of GfK Karlsruhe, SCK/CEN Mol, RCN Petten, and TNO Apeldoorn. Most of these efforts have been concentrated upon fuel pin and materials development and on the physics and safety of fast reactors. The status report concludes with a reference to the future program under the Project. (auth)

8064 (EURFNR-1216) FAST BREEDER PROJECT. Second Quarterly Report, 1974. Hueper, R. (comp.). (Kernforschungszentrum Karlsruhe (F.R. Germany)). Oct 1974. Translation of KFK-1274/2. 183p. Dep. NTIS $7.50.

Work performed under United States--Euratom Fast Reactor Exchange Program.

Research progress is reported on fuel pin development, material studies and development, corrosion tests and coolant analysis, fuel cycle studies, physics experiments, fast reactor safety, instrumentation development, environmental studies, and sodium technology tests. Much of the work had SNR-300 design applications. (JWR)

8065 (GA-A-12728) GAS-COOLED FAST BREEDER REACTOR. Quarterly Progress Report, May 1, 1973–July 31, 1973. (Gulf General Atomic Co., San Diego, Calif. (USA)). 10 Oct 1973. Contract AT(04-3)-167. 113p. Dep. NTIS $5.45.

Progress is reported in the following areas: (1) core development, (2) pressure equalization system for fuel, (3) fuels and materials development, and (4) nuclear analysis and reactor physics. (auth)

8066 (GA-A-13102) EXPERIMENT DESCRIPTION AND SAFETY ANALYSIS FOR THE F-3 MIXED-OXIDE FUEL ROD IRRADIATION IN EBR-II. Flynn, P. W.; Hinz, R. F.; Langer, S.; Lindgren, J. R. (General Atomic Co., San Diego, Calif. (USA)). 30 Oct 1974. Contract AT(04-3)-167. 37p. Dep. NTIS $4.00.

The F-3 fuel-rod irradiation experiment in EBR-II is a continuation of the GCFR fast-flux fuel irradiation program. The F-3 experiment will provide a fluence-to-burnup ratio and total fluence (1.5×10^{23} n/cm^2 at approximately 100,000 MWd/Te) that is more representative of GCFR fuel-rod operating conditions. Cladding temperatures will be in the range 700° to 750°C with peak linear power generation rates of 14 to 16.5 kW/ft (46 to 54 W/mm). The mixed-oxide $(Pu,U)O_2$ pellets are contained in ribbed, 20 percent cold-worked 316 stainless-steel cladding. Both solid and annular pellets of 1.94 and 1.98 oxygen-to-metal ratio are used. Activated charcoal traps are contained in all fuel rods to determine the effects of fast-neutron irradiation on the sorption characteristics for fission products of the charcoal. Silicon-carbide temperature monitors and both wire and coated U,Th particle dosimeters are contained in each fuel rod. (auth)

8067 (GA-A-13379) GAS-COOLED FAST BREEDER REACTOR. Quarterly Progress Report for the Period November 1, 1974–January 31, 1975. (Gulf General Atomic Co., San Diego, Calif. (USA)). 20 Mar 1975. Contract AT(04-3)-167. 206p. Dep. NTIS $7.60.

Progress is reported in the following areas: (1) core-element development, (2) fuels and materials development, (3) nuclear analysis and reactor physics, (4) pressure-equalization system for fuel, (5) core assemblies structural-thermal-flow tests, (6) gas reactor-in-pile safety test loop program, (7) reactor engineering, (8) refueling system development, (9) component development engineering, (10) shielding requirements, and (11) fuel rod engineering. (DG)

8068 (HEDL-TME-75-27) SODIUM FROST OBSERVATIONS ON CRCTA CONTROL ROD DUMMY PLUGS. Danker, W. J. (Hanford Engineering Development Lab., Richland, Wash. (USA)). Mar 1975. Contract AT(45-1)-2170. 23p. AT.

Prior to fill of the Composite Reactor Components Test Activity (CRCTA) vessel, several of the vessel cover plugs were modified to investigate sodium frost build-up effects in the various plug annuli during the first temperature ascent to 1100°F. To obtain comparative data on the frosting phenomenon, convection restrictor rings were welded on two of the Control Rod Dummy plugs to close the annulus to 30 mils radial clearance and a third plug was not modified (leaving approximately $\frac{1}{8}$'' annulus past the thermal shields up into the head area). The total time during which the Control Rod Penetration Dummy Plugs were exposed to sodium vapor was 95 to 98 days. One of the more notable conclusions of this exercise was verification of the effectiveness of the convection restrictor design. Pictures of the plugs demonstrate that sodium frost deposition was effectively inhibited by the convection restrictor. (auth)

8069 (KFK-1274/3, pp vp) GAS COOLED FAST BREEDERS. Marek, J.; Rehme, K.; Roth, A. Dec 1974. (In German).

6 figs.; 2 refs.

In 3rd quarter annual report 1974. (Kernforschungszentrum Karlsruhe (F. R. Germany). Projekt Schneller Brueter).

Studies on the temperature distribution along pipes with spacers and on heat transfer in fuel element clusters are reviewed. (GE)

8070 (KFK-1274/3, pp vp) SODIUM TECHNOLOGY EXPERIMENTS WITH RESPECT TO FAST BREEDERS. Kleefeldt, K. Dec. 1974. (In German).

3 figs.

In 3rd quarter annual report 1974. (Kernforschungszentrum Karlsruhe (F. R. Germany). Projekt Schneller Brueter).

The operating behavior of antifriction bearings and the welding and wear studies in sodium are described. Heat transfer measurements in fuel cluster geometries are described. Hydraulic studies of the SNR-300 absorber are dealt with. (GE)

8071 (NP-20380, pp 2.1–2.13) BREEDER REACTORS. Reichle, L.F.C. (Ebasco Services, Inc., New York). 1974.

In status report: energy resources and technology.

The various alternative breeder reactors which are presently being considered as potentially adaptable for commercial application are discussed. The relationship of breeder reactors to the fuel situation is examined. The reactor types discussed include LMFBR, GCFR, motten salt breeders, and light water breeders. (JWR)

8072 (TID-3333-S2) LIQUID METAL FAST BREEDER REACTORS: JULY 1973–DECEMBER 1974. Cunningham, D. C.; Galde, D. O. (Comps.). (Energy Research and Development Administration, Oak Ridge, Tenn. (USA). Technical Information Center). Jun 1975. 269p. Dep. NTIS $7.60.

Included are 1,966 citations to LMFBR references listed in Nuclear Science Abstracts Volumes 28 (July 1973) through 30 (December 1974). Personal Auther, Report Number/Availability, and Subject Indexes are provided. (auth)

8073 (TID-26768) SODIUM IONIZATION LEAK DETECTOR. Monthly Progress Letter Report for March 1975. Lane, S. A. (Westinghouse Electric Corp., Hunt Valley, Md. (USA). Nuclear Instrumentation and Control Dept.). 8 Apr 1975. Contract AT(11-1)-2499. 4p. AT.

Progress is reported in sensor design optimization and response studies, electrical signal generation and processing, and testing in simulated reactor environment. (DG)

8074 (TUBIK-37) ANALYTICAL SOLUTION FOR THE TEMPERATURE FIELDS IN ROD BUNDLES COOLED BY LIQUID METALS FLOWING LONGITUDINALLY IN ANY PREDETERMINED HEAT FLUX. Meier, S. (Technische Univ. Berlin (F. R. Germany). Inst. fuer Kerntechnik). Dec 1974. 137p. (In German). Dep. NTIS (US Sales Only) $10.00.

Thesis.

Special attention has been devoted to the highly asymmetric flow channels in LMFBR fuel rod bundles which prevail around the rods adjacent to the duct wall and around interior rods when laterally displaced from their proper location within an otherwise regular array. Since at typical LMFBR conditions fully developed temperature fields may hardly be established in these bundle regions, a three-dimensional heat transfer analysis is required. Assuming slug flow, the classical analytic solution involving separation of variables and subsequent solution of the Sturm-Liouville eigenvalue problem has been applied to solve the three-dimensional heat transfer problem in a geometrically generalized fluid region of a hexagonal rod bundle. It is demonstrated that results for fully developed heat transfer may be far too conservative when applied to reactor situations. (auth)

8075 (WARD-D-0100) CLINCH RIVER BREEDER REACTOR PROJECT. 1974 Technical Progress Report. (Westinghouse Electric Corp., Madison, Pa. (USA). Advanced Reactors Div.). [nd]. 226p. TIC.

The Clinch River Breeder Reactor Project objectives, design decisions, and major accomplishments achieved in the planning, organizing, design and licensing are described. The CRBRP is the United States' Liquid Metal Fast Breeder Reactor Demonstration Plant. The period covered by this report starts with February 19, 1973 when the contract was initiated and includes work done through August 31, 1974. Key accomplishments of the project during this initial period are as follows: the site has been chosen; major plant system concepts have been selected; project management requirements and scopes of responsibility were defined; the site geology survey was completed; a reference design was established and documented; conceptual general arrangement drawings were completed, preliminary general arrangement drawings are in process; major system design descriptions have been completed; key equipment specifications were completed; orders have been placed for critical long-lead materials; preliminary safety analysis and environmental report drafts were issued for project review; proposals for general contractor and site excavation were prepared and issued for project review; rfq's were issued for intermediate heat exchangers, control rod drive mechanisms, steam generators, reactor vessel, closure head, reactor guard vessel, sodium pumps, and containment vessel, and turbine-generator; and initial efforts were undertaken for design of the intermediate heat exchanger and the reactor vessel. (auth)

8076 (WARD-OX-3045-16) OXIDE FUEL ELEMENT DEVELOPMENT. Quarterly Progress Report for Period Ending December 31, 1974. Boltax, A.; Saling, J. H. (Westinghouse Electric Corp., Madison, Pa. (USA). Advanced Reactors Div.). Apr 1975. Contract E(11-1)-3045. 60p. AT.

Progress is reported in the following areas: (1) coordination and evaluation of mixed-oxide irradiation tests, (2) post-irradiation examination of fast reactor experiments, (3) LMFBR grid-type fuel assembly design and evaluation, (4) fabrication, development, and testing of LMFBR fuel assemblies, (5) evaluation and analysis of fuel and cladding irradiation behavior, and (6) improvement of analytical methods and lifetime codes. (DG)

8077 APPLICATION OF SEQUENTIAL UNCONSTRAINED MINIMIZATION TECHNIQUE TO LMFBR CORE DESIGN OPTIMIZATION PROBLEM. Kobayashi, Y.; Kondo, S.; Togo, Y. (Tokyo Univ. (Japan). Faculty of Engineering). J. Nucl. Sci. Technol. (Tokyo); 11: No. 11, 471-479(Nov 1974).

An LMFBR core design optimization procedure in which the sequential unconstrained minimization technique (SUMT) using the conjugate direction method for the unconstrained minimizer is adopted as the optimization algorithm. To minimize computing effort in estimating the equilibrium core condition, the procedure utilizes the regression functions of the burnup characteristics in a simplified method of calculation which is called the "power balance method." As a numerical example, the procedure was applied to calculations on a 1000 MW(e) LMFBR core design, on which an evaluation is also made of the sensitivity shown by the results to changes in critical constraints. It is shown that the optimization algorithm based on SUMT is well applicable to core design optimization, provided careful attention is paid in treating the penalty term of the transformed performance index in order to obviate a discontinuity occurring in the locus of the optimized solution at the constraint boundary. It is also demonstrated that the simplified method of burnup calculation is helpful in reducing computer time. Further, some considerations are presented on such aspects as the behavior of the design variables, computing effort required, and the main characteristics of the optimized core. (auth)

8078 RADIONUCLIDE BEHAVIOR DURING NORMAL OPERATION OF LIQUID-METAL-COOLED FAST BREEDER REACTORS. II. Transport. Erdman, C. A.; Kelly, J. L.; Reynolds, A. B. (Univ. of Virginia, Charlottesville). Nucl. Saf.; 16: No. 3, 318-336(1975).

The second part of a two-part article on radionuclide behavior during normal operation of a liquid-metal-cooled fast breeder reactor (LMFBR) is presented. Part 1 discussed the production of radioactivity; Part 2 reviews the transport of the various radionuclides. Although reliance was placed on published results for both parts, some new calculations were made where needed. Results were normalized to a 1000-MW(e) LMFBR and compared with values for a light-water reactor (LWR). This review includes the transport of tritium and corrosion products, transport of fission products from failed fuel, behavior of radioactivity in sodium and cold traps, and operation of gaseous radwaste systems. Operating experiences are reviewed for the fast reactors EBR-II, Fermi, SEFOR, Dounreay, Rapsodie, and BR-5; limited data are given for the thermal reactors SRE, S8ER, and Hallam. (98 references) (auth)

8079 GAS-COOLED BREEDER REACTOR WITH GAS TURBINES AND DRY-COOLING TOWERS. Mandell, D. A.; Hinman, G. W.; Sorensen, H. A.; Horton, R. M. (Washington State Univ., Pullman). pp 11.1-11.24 of Energy, Environment, and Engineering. Stillwater, OK; Oklahoma State Univ. (1973).

From proceedings on frontiers of power technology; Stillwater, Oklahoma, USA (10 Oct 1973). See CONF-731096-.

The purpose of this project is to conduct a systems evaluation of a gas-cooled fast reactor (GCFR) coupled to a gas turbine and using a dry cooling tower for waste heat rejection. The major goal of the project is to define those R and D problems which must be solved before the above system can become commercially and environmentally acceptable. The results indicate that the system offers a number of advantages over other proposed nuclear systems, and that a demonstration plant should be built at an early date. The following major problems require additional work: (1) Development of a new cladding material, (2) Optimization of the gas turbine dry tower combination, and (3) Construction and testing of a large closed cycle, nuclear gas turbine. (auth)

8080 TESTS ON PHENIX NUCLEAR POWER PLANT. Reactor Testing. Branchu, J.; Crochon, J. P. (Groupement pour les Activites Atomiques et Avancees (GAAA), 92- Le Plessis-Robinson (France)); Debergh, P. (Electricite de France, 77-Ecuelles); Defauchy, J.; Gamma, J. M.; Maulard, J.; Mazzon, J. C. (Societe Technique pour l'Energie Atomique (Technicatome), Centre d'Etudes Nucleaires de Saclay, 91- Gif-sur-Yvette (France)). Bull. Inf. Sci. Tech. (Paris).; No. 199, 45-60(Jan 1975). (In French).

Results of tests carried out on the reactor Phenix are given in the following fields: hydraulic and mechanical, vibrations; thermal and mechanical; working of mechanisms (rotating plug, control rods). (FR)

8081 TESTS ON PHENIX NUCLEAR POWER PLANT. Tests on Fuel Handling and Special Handling Systems. Mulot, P. (Societe Technique pour l'Energie Atomique (Technicatome), Centre d'Etudes Nucleaires de Saclay, 91- Gif-sur-Yvette (France)). Bull. Inf. Sci. Tech. (Paris).; No. 199, 75-79(Jan 1975). (In French).

The fuel element handling and special handling equipment was tested in phases 1 and 2 of the Phenix start-up tests. Working tests on the materials, first in air and then in sodium, took place without any serious hitch. The equipment was ready to serve for all handling operations by the beginning of phase 3. (FR)

8082 TESTS ON PHENIX NUCLEAR POWER PLANT. Tests on the Electricity Production Unit. Beaudenon, M. (Electricite de France, 75- Paris). Bull. Inf. Sci. Tech. (Paris).; No. 199, 87-89(Jan 1975). (In French).

The electricity production unit of Phenix is defined as the water-vapor part of the plant, steam generators being excluded. The unit testing is reviewed according to the time sequence. (FR)

8083 TESTS ON PHENIX NUCLEAR POWER PLANT. Operation Testing. Acket, C. (Groupement pour les Activites Atomiques et Avancees (GAAA), 92- Le Plessis-Robinson (France)). Bull. Inf. Sci. Tech. (Paris).; No. 199, 17-29(Jan 1975). (In French).

The starting of the functional units was effected as planned in operation notices without major trouble. Results reported are essentially tests of various units, attention being given to the more important and troublesome ones: power plant control, start-up and shutdown, scram, safety problem, after-heat removal. (FR)

8084 TESTS ON PHENIX NUCLEAR POWER PLANT. Circuit Testing. Noel, H. (Societe Technique pour l'Energie Atomique (Technicatome), Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France)). Bull. Inf. Sci. Tech. (Paris).; No. 199, 31-44(Jan 1975). (In French).

Tests organization and execution are presented: preparation for sodium filling, sodium filling of the reactor and main circuits, and results of tests on the most important functional units. (FR)

8085 TESTS ON PHENIX NUCLEAR POWER PLANT. Core Testing. Clauzon, P.; Gourdon, J.; Chantot, H.; Chenal, J. C.; Coulon, G.; Gouriou, A.; Humbert, G.; Jallade, M.; Ladet, J.; Martin, J. (CEA Centre d'Etudes Nucleaires de Cadarache, 13- Saint-Paul-les-Durance (France). Dept. des Reacteurs a Neutrons Rapides). Bull. Inf. Sci. Tech. (Paris).; No. 199, 61-74(Jan 1975). (In French).

The core tests are described, the main purpose being to ensure the nuclear start-up of the plant, to determine the physical characteristics needed by the operator for a good management of the core elements and finally, on the basis of the results observed, to propose any changes necessary in the specifications of new fuel and control rod loads. All the results obtained during the physical tests without power and during the power rise are presented. (FR)

8086 TESTS ON PHENIX NUCLEAR POWER PLANT. General Presentation of the Tests. Guillemard, B. (Societe Technique pour l'Energie Atomique (Technicatome), Centre d'Etudes Nucleaires de Saclay, 91- Gif-sur-Yvette (France)). Bull. Inf. Sci. Tech. (Paris).; No. 199, 5-16(Jan 1975). (In French).

The aim of Phenix testing during start-up was to assume a gradual starting of the plant with a maximum reduction of the risks inherent to its prototype aspect and dimensions. Test execution is reported in the sequential order: test before sodium filling of the main circuits, before core charging, before power rise and during power rise. (FR)

Research, Test, and Experimental Reactors

Refer also to abstracts 6479, 8058, 8063, and 8233.

8087 (AAEC/E-343) COMPARISON OF CALCULATIONS OF A REFLECTED REACTOR WITH DIFFUSION, SN AND MONTE CARLO CODES. McGregor, B. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). Jan 1975. 13p. Dep. NTIS (US Sales Only) $4.00.

A diffusion theory code, POW, was compared with a Monte Carlo transport theory code, KENO, for the calculation of a small C/^{235}U cylindrical core with a graphite reflector (mockup of Moata Reactor). The calculated multiplication factors were in good agreement but differences were noted in region-averaged group fluxes. A one-dimensional spherical geometry was devised to approximate cylindrical geometry. Differences similar to those already observed were noted when the region-averaged fluxes from a diffusion theory (POW) calculation were compared with an SN transport theory (ANAUSN) calculation for the spherical model. Calculations made with SN and Monte Carlo transport codes were in good agreement. It was concluded that observed

flux differences were attributable to the POW code, and were not inconsistent with inherent diffusion theory approximations. (auth)

8088 (CEA-N-1779) 200 GROUP DOPPLER EFFECT CALCULATION FOR THE ERMINE EXPERIMENT. Banifatemi, A.; Guyader, A.; Kavenoky, A. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Div. d'Etude et de Developpement des Reacteurs). Jan 1975. 28p. (In French). Dep. NTIS (US Sales Only) $4.50.

The doppler reactivity effect of uranium 238 was measured by the oscillation technique; the experiment was done in the subcritical fast assembly ERMINE coupled to the thermal reactor MINERVE by a spectrum converter. A perturbation calculation was performed by the EXCALIBUR code. In the experimental cell, direct and adjoint heterogeneous fluxes have been computed; a surface source corresponding to ERMINE flux was assumed at the boundary of the cell. The computations were done with 200 groups and refined self-shielding calculations were performed. The agreement between calculation and experiment is good. (auth)

8089 (CONF-750413-P1, pp I.71-I.82) EXPERIENCE WITH SINGLE-CHANNEL FLUX SYNTHESIS CALCULATIONS FOR THREE-DIMENSIONAL, FAST REACTOR MODELS. Adams, C. H.; Lineberry, M. J. (Argonne National Lab., IL). 1975.

From ANS computational methods in nuclear energy; Charleston, South Carolina, USA (15 Apr 1975).

In proceedings of the conference on computational methods in nuclear engineering. Vol. I. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.; Energy Research and Development Administration, Aiken, S. C. (USA). Savannah River Operations Office).

As part of the analysis program for ZPPR critical assemblies a new computer code, SYN3D, has been used to perform spatial flux synthesis calculations of three-dimensional, diffusion theory models. SYN3D is described, as are the procedures employed in choosing synthesis expansion functions to represent core and blanket zones. Computing times for synthesis calculations seem to be roughly equivalent to the times required to generate the expansion functions. An anomaly affecting only the low-energy group fluxes was found in one of the models studied. (14 references) (auth)

8090 (CONF-750604-1) USE OF EBR-II AS A PRINCIPAL FAST BREEDER REACTOR IRRADIATION TEST FACILITY IN THE U.S. Staker, R. G.; Seim, O. S.; Beck, W. N.; Golden, G. H.; Walters, L. C. (Argonne National Lab., Ill. (USA)). 1975. Contract W-31-109-Eng-38. 28p. Dep. NTIS $4.50.

From US/USSR seminar on fast breeder reactor construction and experience; Obinsk, USSR (2 Jun 1975).

The EBR-II as originally designed and operated by the Argonne National Laboratory was successful in demonstrating the operation of a sodium-cooled fast breeder power plant with a closed fuel reprocessing cycle. Subsequent operation has been as an experimental facility where thousands of irradiation tests have been performed. Conversion to this application entailed the design and fabrication of special irradiation subassemblies for in-core irradiations, additions to existing facilities for out-of-core irradiations, and additions to existing facilities for out-of-core experiments. Experimental subassemblies now constitute about one third of the core, and changes in the core configuration occur about monthly, requiring neutronic and thermal-hydraulics analyses and monitoring of the reactor dynamic behavior. The surveillance programs provided a wealth of information on irradiation induced swelling and creep, in-reactor fracture behavior, and the compatibility of materials with liquid sodium. (auth)

8091 (EUR-5198e) LWR FUEL IRRADIATION FACILITIES IN THE HFR PETTEN. Markgraf, J.; Zeisser, P. (Commission of the European Communities, Luxembourg; Commission of the European Communities, Petten (Netherlands). Joint Nuclear Research Center). Jul 1974. 35p. (CONF-740742-2). Dep. NTIS (US Sales Only) $4.75. EUR B.Fr. 60,-.

From meeting of the euratom work group on irradiation devices; Harwell, UK (2 Jul 1974).

The light water cooled and moderated High Flux Reactor (HFR) at the Joint Research Centre of the EC at Petten, Netherlands, offers various facilities for Light Water Reactor fuel testing. The Pool Side Facility is the most suitable for this purpose because of the easy access, and the elevated thermal neutron flux density of 2.5×10^{14} $cm^{-2}sec^{-1}$. Both of these features combined with a remote controlled displacement unit offer advantages for experiments which require constant fission rate, power cycling, power ramps and transient overpower. A number of irradiation devices are available to perform irradiations of canned or of bare fuel or vented pins over a large range of temperatures and powers. None of these devices makes use of electrical heaters and the required power to temperature relation is obtained by the selection of the heat transfer medium. Helium, liquid metals, and boiling water are currently applied in pressurized capsules. Forced flow of H_2O is used in the high pressure water loop, which is a permanent installation in the reactor. An outline is presented of the reactor facilities, the various irradiation devices which are available, and their particular features as well as a number of examples of experiments which have been carried out in the past. 11 references. (auth)

8092 (HEDL-TME-75-6) FFTF PROTOTYPE INSTRUMENT TREE SHAKER TESTS. White, R. G.; Simmons, M. D. (Hanford Engineering Development Lab., Richland, Wash. (USA)). [nd]. Contract AT(45-1)-2170. 83p. AT.

Natural frequencies, mode shapes and damping values were experimentally determined on an FFTF prototype Instrument Tree. Instrumentation Guide Tubes were subjected to additional testing to verify characteristic response frequencies. Testing was performed at ambient temperature in the HEDL Core Mechanical Mockup in the High Temperature Sodium Facility. Response data was acquired from accelerometers installed at above-head locations to study the feasibility of "remote" location vibration monitoring. Data analysis has established the potential feasibility for main-structure monitoring; however, the substructure monitoring results were poor. (auth)

8093 (JAERI-M-5845) REPORT ON THE OPERATION, UTILIZATION AND TECHNICAL DEVELOPMENT OF RESEARCH REACTORS AND HOT LABORATORY. (Japan Atomic Energy Research Inst., Tokyo). Sep 1974. 190p. (In Japanese). INIS.

The main projects of the Division are operation and maintenance of JRR-2, JRR-3, and JRR-4, and post irradiation test at Hot-Laboratory. In performance of the works mentioned, research and development were made in various fields of reactor engineering such as operation and maintenance of reactors, technical management of fuels and coolants, radiation control and irradiation technique, etc. TLG-1 (Technical Laboratory Gas Loop-1) was removed from the JRR-2 at the end of fiscal 1973. This equipment had been used for the development of irradiation technique and the studies on behavior of fission products for eight years. Post irradiation tests of various fuels and materials were performed at the Hot Laboratory as well as the technical development of test procedures. (auth)

8094 (JAERI-M-5861) EXPLOSIVE PROOF TEST OF NSRR EXPERIMENTAL CAPSULE. Fujishiro, T.; Iwata, K.; Kikuchi, T.; Yoshihara, F.; Hoshi, T. (Japan Atomic Energy Research Inst., Tokyo). Oct 1974. 37p. (In Japanese). INIS.

NSRR experimental capsules are designed as pressure vessels to withstand and confine mechanical energy such as pressure pulses and water hammer forces generated at experimental fuel rupture. To prove the safety margin of the capsule, it is required to perform mock-up tests using chemical explosives. The results of explosive tests carried out with full size models of Type I in-pile capsules are presented. Chemical explosives of 10g or 50g were charged at the fuel position in the test capsule, and fired by an electric detonator. Shock pressures, capsule wall transient and residual deformations and water column jumping speed were measured. For testing the "Gripping Device" which is to be used for fixing the capsule in place, a similar mock-up was built and used throughout the tests. Assessing the results of all these test experiments, it was confirmed that the capsule and the gripping device have enough margin against the destructive pressures to be generated in the designed NSRR fuel rupture experiments. (auth)

3095 (JUL-1136-RG) THEORETICAL ANALYSIS OF THE CRITICAL EXPERIMENT KAHTER. Scherer, W.; Gerwin, H.; Neef, R. D. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Reaktorentwicklung). Nov 1974. 141p. (In German). Dep. NTIS (US Sales Only) $10.25.

In 1973 and 1974 the critical HTR-Pebble-Bed Experiment KAHTER with homogeneous loading was performed. The aim of the experiment was to test standard computer codes and methods for HTR design with respect to their validity and accuracy. The experiment is described and the codes and calculation methods which have been used are reported. Furthermore the study includes a detailed comparison of measured and calculated reactor data such as critical mass, absorber rod reactivities and reaction rates of various detectors. Whereas the critical loadings and the rod efficiencies are well reproduced by theory, the reaction rates show deviations especially inside the reflector. Besides uncertainties of the measured values, possible reasons for these differences are a too coarse energy structure of the calculation model as well as effects due to the use of different nuclear libraries. (auth)

8096 (LA-5920-MS) COOLING TOWER MODIFICATION FOR INTERMITTENT OPERATION. Midkiff, W. S. (Los Alamos

Scientific Lab., N. Mex. (USA)). Mar 1975. Contract W-7405-eng-36. 4p. Dep. NTIS $4.00.

One of the cooling towers at Los Alamos Scientific Laboratory is being operated intermittently. The cooling tower has been modified to restrict air flow and to keep the tower from drying out. The modifications are relatively inexpensive, simple to operate, and have proved effective. (auth)

8097 (SRD-R-35(Pt.2)) PART II: DIFFUSION COEFFICIENTS OF FISSION PRODUCTS IN HELIUM. Lawler, M. J. (UKAEA Safety and Reliability Directorate, Culcheth). [nd]. 9p. (RPC/M-3FPR/P-(74)5). Dep. NTIS (US Sales Only) $4.00.

Using the methods described in Part I, best fit values of diffusion coefficients in helium have been obtained for ^{137}Cs, ^{111}Ag and ^{89}Rb from Dragon heat exchanger deposition profiles. The values found are higher than theoretical values obtained from the Chapman - Enskog formula. The value calculated for ^{89}Rb is a minimum value which could be considerably higher if the amount of inert gas precursor ^{89}Kr which decayed to ^{89}Rb in the heat exchangers was significant in determining the profile. (auth)

8098 (TUBIK-42) EXPERIMENTAL DETERMINATION OF THE α-DECAY CONSTANTS AT THE ZERO POWER REACTOR SUR 100 BE. Experiments with Pulsed Neutron Sources: Effect of Higher Harmonics and Detector Position. Rossi α Experiment: Influence of Reactivity, Source Intensity, and Measurement Errors. Lickteig, K. (Technische Univ. Berlin (F. R. Germany). Inst. fuer Kerntechnik). Feb 1975. 185p. (In German). Dep. NTIS (US Sales Only) $12.25.

8099 (UJV-3357-R-Ch) REMOVAL OF LOW CONCENTRATIONS OF BORIC ACID IN WATER USING ION EXCHANGE. Kysela, J.; Brabec, J.; Peterka, F. (Ustav Jaderneho Vyzkumu, Rez (Czechoslovakia)). Jan 1975. 21p. (In Czech). Dep. NTIS (US Sales Only) $4.25.

The boric acid poisoning of a moderator of the TR-O experimental HW reactor is studied. For this reason a possibility of removing boric acid out of the heavy water by means of a strong basic anion exchanger down below a redundance concentration is discussed. By measuring the useful capacities of Zerolit FF, a strong basic anion exchanger, it has been found out that the penetration of boric acid during the sorption period does not exceed a value of 0.015 mg B/l. A relation of capacity versus boric acid concentration in the solution has been determined. Analytical methods used to determine B in the water are described as well. 14 references. (auth)

8100 (WANL-TME-144) WESTINGHOUSE ASTRONUCLEAR LABORATORY PRELIMINARY PROPOSAL TO PLUM BROOK REACTOR FACILITY FOR THE NERVA RADIATION EFFECTS PROGRAM. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 13 Aug 1962. 36p. Dep. NTIS $5.00.

The NERVA Radiation Effects Program requirements as pertaining to the Plum Brook facility and the general plan for fulfilling these requirements using horizontal through holes, HT-1 and HT-2 are outlined. The purpose of the NERVA Radiation Effects Program is to test materials and components under conditions simulating certain parameters of the anticipated NERVA reactor environment. The objectives are to: Determine the performance and reliability of NERVA subsystems and systems under a physical and nuclear environment simulating operating conditions; and determine the effects of radiation on physical and mechanical characteristics of NERVA materials both fueled and nonfueled. A thorough survey of various reactor facilities indicated that the Plum Brook facility is essential in order to fulfill the requirements: neutron flux levels of greater than 10^{14} n/cm^2 sec; temperatures from 50° to 5000°R; availability of irradiation space large enough to accommodate test specimens in the required flux; and ability to insert and withdraw instrumented capsules during full power operation of the reactor. The Plum Brook Reactor Facility presently cannot meet all of these requirements. However, with the proposed facility additions, these capabilities could be provided. It is estimated that the cost of these proposed facility additions will not exceed $520,000. (auth)

8101 (WANL-TME-169) WESTERN NEW YORK NUCLEAR RESEARCH CENTER REACTOR PROGRAM. Kalapaca, H. P. (Comp. and Ed.). (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 6 Nov 1962. 37p. Dep. NTIS $5.00.

The Western New York Nuclear Research Center Reactor program to investigate radiation effects on electronic equipment is described (coaxial cables, electron tubes, electric insulating coatings, impedance converters, preamplifiers). (LTN)

8102 (WARD-2171-47) FAST FLUX TEST FACILITY. Quarterly Progress Report for the Period Ending May 31, 1974. (Westinghouse Electric Corp., Madison, Pa. (USA). Advanced Reactors Div.). 1974. Contract AT(45-1)-2171. 29p. AT.

Development and testing activities for the FFTF reactor are reported under the following headings: reactor systems and components; in-vessel-handling machine and instrumentation and control systems and components; plant mechanical components and heat transport system; nuclear safety; and materials application and development testing. (JWR)

Production and Materials Testing and Processing Reactors

Refer also to abstracts 8272, 8282, and 8283.

8103 (CONF-750413-P2, pp VI.123-VI.141) THREE-DIMENSIONAL COUPLED NEUTRONIC AND ENGINEERING CALCULATIONS OF SAVANNAH RIVER REACTORS. Anderson, M. M.; Buckner, M. R.; Carswell, J. H.; Dodds, H. L.; Gregory, M. V.; Honeck, H. C.; Routt, K. R.; Stewart, J. W. (E. I. du Pont de Nemours and Co., Aiken, SC). 1975.

From ANS computational methods in nuclear energy; Charleston, South Carolina, USA (15 Apr 1975).

In proceedings of the conference on computational methods in nuclear engineering. Vol. II. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.; Energy Research and Development Administration, Aiken, S. C. (USA). Savannah River Operations Office).

A coupled, three-dimensional model of Savannah River reactors has been developed for use in design and safety analysis studies. Fewgroup neutron diffusion theory is used to describe the neutronic behavior; the engineering state is determined by applying conservation of mass, energy, and momentum to the entire reactor system. The neutronic and engineering calculations are coupled by a set of parametric equations which represent the lattice fewgroup parameters as functions of neutronic and engineering state variables. The model equations for the many interacting components of the reactor system are solved by a system of JOSHUA modules called GRASS. The system is currently being evaluated and optimized. 12 references. (auth)

8104 (DP-1380) JOSHUA SYSTEM. Honeck, H. C. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.). Apr 1975. Contract AT(07-2)-1. 45p. Dep. NTIS $4.00.

A major computational system called JOSHUA has been under development at the Savannah River Laboratory since 1968. The JOSHUA System has two major parts: the Operating System and the Application System. The Operating System has been in production use since 1970 and provides data management, terminal, and job execution facilities. The Application System uses these facilities in solving problems in reactor physics and engineering. Features of the Application System are the two-dimensional lattice physics and three-dimensional transient reactor physics capabilities, which have been in use since 1971 and 1974, respectively. The capabilities of the JOSHUA System are summarized, and statistics on size, use, and development effort are provided. (auth)

8105 (JAERI-M-5834) THE DEVELOPMENT OF AN IN-PILE CREEP FACILITY IN JMTR. Miyao, J.; Shimizu, M.; Ishii, T.; Tsuyuzaki, N. (Japan Atomic Energy Research Inst., Tokyo). Sep 1974. 90p. (In Japanese). INIS.

Since 1969, efforts had been made on the development of an in-pile creep facility in JMTR. It was completed in the spring of 1971, and irradiation tests were started with the No. 10 cycle of JMTR operation (July, 1971). The design and construction details of the in-pile creep capsule, the method of creep strain measurement with a helium-micrometer, and the facility itself are described. During the past two years, the facility had been improved; and the technique of in-pile creep test has proved to be satisfactory. (auth)

Propulsion and Package Reactors

Refer also to abstracts 7026, 7060–7065, 7191, 7192, 7871, 8100, 8101, 8232, 8239–8241, and 8375.

8106 (AGC-2305) COMPARISON OF GIMBAL AND GAS INJECTION SYSTEMS FOR THRUST VECTOR CONTROL OF THE NERVA ENGINE. (Aerojet-General Corp., Azusa, Calif. (USA)). Jul 1962. 14p. Dep. NTIS $4.00.

Declassified 7 Sep 1973.

A comparison of fluid injection and gimbal thrust-vector control systems for the NERVA engine confirmed the original selec-

tion of the gimbaled system for this application. The comparison involved consideration of reliability, effect on other engine components, effect on engine performance, and structural and installed weight as well as vehicle response and torque requirements. (auth)

8107 (AGC-2506) MANDATORY FACILITY ADDITION ENGINE TEST STAND NO. 1 AT NRDS. (Aerojet-General Corp., Azusa, Calif. (USA)). Jun 1963. 130p. Dep. NTIS $9.50.
Declassified 10 Sep 1973.
Since it was necessary to initiate the design and installation of the ETS-1 facilities prior to completion of the NERVA engine design, portions of the facilities design had to be based upon incomplete or preliminary data. In addition, it was necessary to delay or withhold certain areas of the ETS-1 facilities design and installation because of a close association with later phases of the engine development, or the lack of previous funding. It is therefore the intent to outline these deficient, uninitiated, or incomplete items. All of these additions and modifications are mandatory to provide the operational capability required for the NERVA engine development test program. The completed ETS-1 Facility will provide capability for full-scale, 300 second duration full-power NERVA engine static testing. The major items, which have not been released or are incomplete, include: the Fire Protection System, the Radiation Shields, the NERVA exhaust system, and the Instrumentation and Controls (I&C) System. The additions and modifications resulting from program requirement changes include: additional gas storage and recharging equipment, standby equipment, tunnel and power system modifications relative to the I&C, and safety items such as a change house, blast doors and dewar dyking. The systems associated with the engine development which must be designed and applied by REON include: the propellant supply line, the engine to test stand thrust structure and adapter, the engine control actuation fluid temperature conditioning, cool-down, remote control, simulator, and other items listed. (auth)

8108 (AGC-2671) PRESENTATION TO MARSHALL SPACE FLIGHT CENTER FOR NERVA THRUST VECTOR CONTROL SYSTEM. (Aerojet-General Corp., Azusa, Calif. (USA)). Aug 1963. 58p. Dep. NTIS $6.00.
Declassified 10 Sep 1973.

8109 (AGC-2703) SUMMARY OF NERVA INSTRUMENTATION REVIEW MEETING AT SNPO-C AUGUST 13, 14, and 15, 1963. (Aerojet-General Corp., Sacramento, Calif. (USA); Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1963. 302p. Dep. NTIS $18.25.
Declassified 10 Sep 1973.
A joint presentation by WANL and AGC personnel reviewed the NRX-A Block I instrumentation, instrumentation development programs, and the data acquisition and analysis methods to be used during the NRX-A test program in Test Cell "A" at the NRDS in Nevada. The work status on instrumentation for NRX-A, Block I, was reported and the problem areas that have been uncovered discussed. (auth)

8110 (AI-AEC-12641) SNAP REACTOR PROGRAMS PROGRESS REPORT, NOVEMBER 1967–JANUARY 1968. Determan, R. L. (Atomics International Div., Canoga Park, Calif. (USA)). 20 Mar 1968. Contract AT(04-3)-701. 174p. Dep. NTIS $11.75.
Declassified 6 Sep 1973.
Information is present concerning fuel development, component development, SNAP 8DR, thermoelectric systems, core analysis and aerospace safety. (DCC)

8111 (AI-AEC-12870) SNAP REACTOR PROGRAMS PROGRESS REPORT, MAY–JULY 1969. Asquith, J. G. (Atomics International Div., Canoga Park, Calif. (USA)). 30 Sep 1969. Contract AT(04-3)-701. 125p. Dep. NTIS $9.25.
Declassified 7 Sep 1973.
Information is presented concerning SNAP 8 DR, reference zirconium hydride reactor engineering, reactor-thermoelectric system engineering, thermoelectric converter development, component development, fuel development, and aerospace safety. (DCC)

8112 (AI-AEC-12953) SNAP REACTOR PROGRAMS PROGRESS REPORT, FEBRUARY–APRIL 1970. (Atomics International Div., Canoga Park, Calif. (USA)). 15 Jun 1970. Contract AT(04-3)-701. 190p. Dep. NTIS $12.50.
Declassified 6 Sep 1973.
Information is presented concerning the SNAP 8 DR, reference zirconium hydride reactor engineering, reactor-thermoelectric system engineering, thermoelectric converter development, component development, fuel development, and aerospace safety. (DCC)

8113 (AI-AEC-12982) SNAP REACTOR PROGRAMS PROGRESS REPORT, AUGUST–OCTOBER 1970. (Atomics International Div., Canoga Park, Calif. (USA)). 15 Dec 1970. Contract AT(04-3)-701. 240p. Dep. NTIS $15.00.
Declassified 6 Sep 1973.
Information is presented concerning SNAP 8 DR, reactor core test, reference ZrH reactor engineering, reactor-thermoelectric system engineering, thermoelectric converter development, component development, fuel development, and aerospace safety. (DCC)

8114 (NAA-SR-12450) ADVANCED THERMOELECTRIC PROGRAM: MODULE FABRICATION DEVELOPMENT. Summary Report. (Radio Corp. of America, Harrison, N. J.). 30 Sep 1967. 95p. Dep. NTIS $7.75.
For Atomics International Div., Canoga Park, Calif. Declassified 28 Nov 1973.

8115 (RN-PA-0001(REV.A)) CLUSTERING OF NUCLEAR ENGINES. (Aerojet-General Corp., Sacramento, Calif. (USA)). Oct 1965. 35p. Dep. NTIS $4.75.
Declassified 12 Sep 1973.
A conceptual design is presented for a medium size nuclear engine which has approximately five times the thrust of the NERVA engine. The cluster study is based upon four of these engines clustered at the base of a vehicle which would be launched from earth's orbit. The weight penalties in the cluster, mostly associated with nuclear shields, are found to increase average engine weight by 29% or less. Neutron interactions between engines are found to be negligible; however, the neutron detectors used for subpower startup must be placed or shielded so that they primarily detect neutrons only from their own reactor. Heat shields are included as a conservative design feature. A rudimentary design of a single large nuclear engine having the same thrust as the entire cluster is presented. The assumed performance of the large engine is compared to the performance of the cluster of medium size engines. (auth)

8116 (RN-PA-0028(Vol. 2)) WESTINGHOUSE ASTRONUCLEAR LABORATORY MATERIAL PRESENTED TO SNPO IN SHIELDING TRADE STUDY REVIEW. Capo, M. A. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.; Aerojet-General Corp., Sacramento, Calif. (USA). Nuclear Div.). 12 Dec 1969. 113p. Dep. NTIS $8.75.
Declassified 12 Sep 1973.

8117 (RN-S-0091) BASIC ANALOG MODEL FOR THE NERVA ENGINE. (Aerojet-General Corp., Azusa, Calif. (USA)). May 1964. 56p. Dep. NTIS $6.00.
Declassified 7 Sep 1973.
A basic engine model is described which is useful in performing dynamic analyses of NERVA systems. The model represents the X-E engine test system and is used for studies of the X-E engine and the Cold Flow Development Test system. The "basic engine" refers to the part of the system which is downstream of the propellant supply and pumping. The equations which describe the basic engine model supply time-continuous solutions of engine variables when solved simultaneously. Using these equations, a description of the heat transfer and coolant flow in the engine can be developed. A technical discussion of the equations is also included. (auth)

8118 (RN-S-0115) DATA ANALYSIS REPORT OF NRX-A1 TESTS. (Aerojet-General Corp., Sacramento, Calif. (USA)). Jul 1964. 329p. Dep. NTIS $19.50.
Declassified 7 Sep 1973.
To upgrade the mathematical models used in the systems analysis effort, an analysis of results from NRX-A1 test series was made. This analysis used pre-test predictions made by the rough cut engine computer program and calculations made using the 364 transient analysis program which became available after the tests were run. A critical analysis of possible mechanisms for flow asymmetry in the nozzle was made. For the AGC nozzle, significant asymmetries occurred only during two-phase flow whereas a consistent asymmetry was present in low temperature tests with the RN-6 nozzle. The results of statistical analyses of narrow band data are also presented. (auth)

8119 (RN-S-0140) PRELIMINARY EVALUATION OF NUCLEAR HAZARDS ASSOCIATED WITH ORBITAL START OF A NUCLEAR ROCKET ENGINE. (Aerojet-General Corp., Sacramento, Calif. (USA)). Sep 1964. 67p. Dep. NTIS $6.50.
Declassified 10 Sep 1973.
The magnitude of the radiation hazards inherent to the orbital operation of a nuclear rocket engine is examined. Orbital lifetime prediction techniques are reviewed and predicted lifetimes are compared with observed data. A world population density

model is described. A statistical analysis model is developed and used to evaluate the probability of radiation exposures to the earth's population following premature thrust termination of the engine. Various counter measure concepts are discussed in terms of their possible utilization in a total flight safety system for the NERVA engine. (auth)

8120 (RN-S-0148(Rev.2)) TEST PLAN FOR COLD FLOW DEVELOPMENT TEST SYSTEM. Second Revision. (Aerojet-General Corp., Sacramento, Calif. (USA)). Sep 1964. 184p. Dep. NTIS $12.25.

Declassified 10 Sep 1973.

The Cold Flow Development Test System (CFDTS) test plan describes tests, instrument requirements, test objectives and test equipment for a non-nuclear cold flow engine test system. The test program will be conducted to evaluate start transients and to develop satisfactory start sequence procedures on a full-scale model of NERVA engine. Tests will be conducted in the H-area test facility of the Aerojet-General Corporation. CFDTS is a full-scale, NERVA XE-1, hot-bleed rocket engine with an unfueled reactor assembly. The major components will be engine prototype models with certain unique CFDTS components provided where necessary, to meet the CFDTS program schedule, and fulfill the functional requirements of the system. (auth)

8121 (RN-S-0198) MINUTES OF THE FOURTH QUARTERLY NERVA INSTRUMENTATION MEETING. (Aerojet-General Corp., Sacramento, Calif. (USA)). Dec 1964. 137p. Dep. NTIS $10.00.

Declassified 10 Sep 1973.

The results of the Fourth Quarterly Instrumentation Review conducted at Space Nuclear Propulsion Office–Cleveland are presented. Emphasis was given to a review of the temperature transducers and end-to-end temperature measurement systems on NRX-A2 from the mixing chamber to the nozzle exit. (auth)

8122 (RN-S-0210) FINAL TEST REPORT FOR PHASE ONE OF THE COUNTERMEASURE RADIATION EFFECTS PROGRAM. (Aerojet-General Corp., Sacramento, Calif. (USA)). Apr 1965. 197p. Dep. NTIS $13.00.

Declassified 10 Sep 1973.

Changes in impact sensitivity of high explosives and propellants were measured as a function of radiation energy deposition rate and total dose. In addition to determining the effect of radiation on the impact sensitivity, data was obtained on weight loss, color changes, detonator firing characteristics, infrared absorption, melting point, X-ray diffraction, differential thermal analysis, viscosity, and ultraviolet absorption. (auth)

8123 (RN-S-0283) COMMON ANALOG MODEL FOR NRX/EST. (Aerojet-General Corp., Sacramento, Calif. (USA)). Jul 1966. 109p. Dep. NTIS $8.50.

Declassified 10 Sep 1973.

The NRX/EST Common Analog Model, devised in accordance with agreements between WANL, AGC, and SNPO-C personnel is described. Changes agreed upon by the three parties are included. The model, however, has not had the benefit of an analysis of NRX/EST data, which will be used to improve this model for XE and NRX-A5. Nozzle and propellant feed system equations were developed by AGC; reactor equations by WANL. In addition to presenting equations for the model, computer and equation checkout procedure is described. Also included is an illustration of how the model was used to predict engine behavior during both normal and malfunction conditions for the NRX/EST test series. (auth)

8124 (RN-S-0289) XE-ENGINE SYSTEMS ANALYSIS DESIGN DATA BOOK. (Aerojet-General Corp., Sacramento, Calif. (USA)). Aug 1966. 269p. Dep. NTIS $16.50.

Declassified 10 Sep 1973.

The X-Engine Design Data Book contains in one volume the most up-to-date information used by Systems Analysis for input into Computer Programs to model the X-Engine. (auth)

8125 (RN-S-0320) NRX-A5 PERFORMANCE-ANALYSIS DATA BOOK. (Aerojet-General Corp., Sacramento, Calif. (USA)). Sep 1966. 142p. Dep. NTIS $10.25.

Declassified 11 Sep 1973.

The major overall objective of the NRX-A5 test series was to demonstrate the capability of the test assembly to operate at design conditions for a total cumulative time of 40 min. It was also planned to evaluate new control concepts, including reactor startup with fixed control drum position. Analytical support of the NRX-A5 test was provided by the Systems Analysis organization, which used component test data and system configurations to form a complete system model for analysis of such conditions as startup, steady-state hold points, cooldown, and emergency cooldown. The latest component test data, the configurations for the NRX-45 engine model, and the transient and steady-state pretest predictions are listed. (auth)

8126 (RN-S-0328) XE/ETS-1 INTERACTION STUDIES STATUS REPORT. (Aerojet-General Corp., Sacramento, Calif. (USA)). [nd]. 78p. Dep. NTIS $7.00.

Declassified 11 Sep 1973.

The effect of the ETS-1 facility on X-Engine operation has emerged as a major consideration in the analysis of the X-Engine. Effectively, the operation of the engine must be analyzed considering the effects and constraints imposed by the facility on the engine. This includes the Nuclear Exhaust System (NES) as it affects allowable chamber conditions, flow rates, and run times, as well as the effect of the NES system generated back pressure on the engine system. Run times are affected by run tank storage availability. Bootstraps are affected by run tank pressure and temperature. The emergency systems studies are significantly affected by propellant systems as to amount of propellant, deliverable pressure and temperature, and the facility-imposed transients on fluid temperature. The majority of the analytical work on the X-Engine is being prepared with the facilities as an integral part of the analysis, and engine system behavior is calculated to determine its compatibility with the ETS-1 facility. Studies are in process on both analog and digital computer with the facilities included as part of the analytical models. The operation that is most facility-dependent is the emergency cooldown system. Since the engine is contained in a closed compartment, safety dictates that the capacity to cool the engine with inert propellants must be available under emergency conditions, and inerts must be used for long-term cooling conditions to minimize the change of fire or detonating the test compartment. To analyze the system with helium and nitrogen as propellants, extensive ground work was necessary to prepare fluid property routines for the digital engine model that are of sufficient accuracy to enable good definition of those fluids over the temperature and pressure range in which they are encountered. (auth)

8127 (RN-S-0490) 75K NERVA ENGINE SYSTEMS ANALYSIS DESIGN DATA BOOK. Petite, D. L. (Aerojet-General Corp., Sacramento, Calif. (USA). Nuclear Div.). Dec 1968. 227p. Dep. NTIS $14.50.

Declassified 12 Sep 1973.

NERVA component performance information required for systems analysis is documented, in particular the information required for input into the D31201 NERVA engine computer model. General and detailed information is given concerning the test facility and engine instrumentation. An input linking of the NERVA Engine Transient Analysis program is included. (LTN)

8128 (RN-TM-0143) TUBE WALL TEMPERATURE EVALUATION PROGRAM. Summary To Date. Rice, R. E. (Aerojet-General Corp., Sacramento, Calif. (USA)). 3 Dec 1964. 37p. Dep. NTIS $5.00.

Declassified 11 Sep 1973.

A basic problem in the development of a liquid rocket thrust chamber is the design of the regenerative coolant tubes. Since the inception of the NERVA program, the various coolant tube designs have been based on heat transfer correlations derived from scale model laboratory tests, but the application of the scale model heat transfer correlations to full scale thrust chambers under maximum operating conditions has never been fully justified. The accuracy of the heat transfer correlations in predicting wall temperature is one of the primary unknowns in the nozzle program at this point. The current status of the experimental program for gas side wall temperature determination is presented, including the methods considered, the results to date and comparison of the data obtained to predicted values. The conclusions drawn from the test results lead into future tasks to improve existing techniques and to extend the techniques to new applications. (auth)

8129 (RN-TM-0179) NERVA XE-ENGINE SHIELD DESIGN DESCRIPTION. Warman, E. A. (Aerojet-General Corp., Sacramento, Calif. (USA)). Apr 1965. 49p. Dep. NTIS $5.50.

Declassified 11 Sep 1973.

The NERVA XE-Engine External Radiation Shield is described. Radiation levels are depicted for the XE-Engine as it appears in the Engine Test Compartment (ETC) of the Engine Test Stand (ETS-1) at the Nuclear Rocket Development Station. The sources of radiation and resultant radiation intensities are provided along with a delineation of the criteria upon which the external engine shield design is based. The effects of the numerous straight through penetrations in the shield are described. Corrective penetration shielding configurations are shown. This document is intended to serve as a guide to those responsible for engine and facility component design and evaluation as well as those reviewing the engine shield fabrication drawing package. The docu-

mentation of fluid line penetration effects on radiation streaming through the shield should be considered as applicable to the engine configuration as of April 1965. Changes in the shield penetrations and corrective shielding in these areas will be updated in later documents. (auth)

8130 (TID/SNA-1772) TURBOPUMP PART RELIABILITY ALLOCATION. Bair, E. K. (Aerojet-General Corp., Sacramento, Calif. (USA)). 28 Sep 1971. 202p. Dep. NTIS $13.25.

A preliminary failure modes analysis for the turbopump and a reliability allocation to the part were made in the fourth quarter of CY 70. These data were judged to be somewhat difficult to use in that they were not, necessarily, related to the basic component failure modes of: Failure to Start, Premature Stop, Low Performance, Total Loss of Containment, Excessive Vibration and External Leakage. Based upon the three basic failure modes of Failure to Start, Premature Stop and Low Performance, a reallocation of reliability to the part level for the turbopump was made. The failure modes of Total Loss of Containment, Excessive Vibration and External Leakage were included under the Premature Stop failure mode. The method used in making the part allocations and the resulting values are discussed. (auth)

8131 (TID/SNA-1859) PHOTOGRAPH FILE: ADAPTER (INJECTOR TO NOZZLE); KIWI ADAPTERS: S/N 001K AND 002K; NERVA ADAPTERS, S/N 001N, 002N, AND 003N. (Aerojet-General Corp., Sacramento, Calif. (USA)). [nd]. 92p. Dep. NTIS $7.75.

8132 (TID/SNA-1860) MISCELLANEOUS PHOTOGRAPHS. (Aerojet-General Corp., Sacramento, Calif. (USA)). [nd]. 37p. Dep. NTIS $5.00.

8133 (TID/SNA-1867) NERVA RELIABILITY PROGRAM SUMMARY. Technical Discussion. (Aerojet-General Corp., Sacramento, Calif. (USA). Nuclear Div.). Jan 1970. 334p. Dep. NTIS $19.75.

A number of memos relating to the reliability of several NERVA components have been bound together and documented. The methods used are described in some cases. (LTN)

8134 (TID/SNA-1871) NERVA RELIABILITY PROGRAM SUMMARY, TECHNICAL DISCUSSION. (Aerojet Nuclear Systems Co., Sacramento, Calif. (USA)). May 1970. 355p. Dep. NTIS $20.75.

Several memoranda related to the reliability of various components or of the whole engine have been documented. (LTN)

8135 (TID/SNA-1873) PRELIMINARY NERVA ENGINE SYSTEM FAILURE MODE, EFFECTS AND CRITICALITY ANALYSIS. (Aerojet Nuclear Systems Co., Sacramento, Calif. (USA)). 1970. 259p. Dep. NTIS $16.00.

A failure mode listing was derived for the component design concepts appropriate for the NERVA engine system and documented in drawing 1137401, dated 3 March 1970, for use as a start point for analysis of system effects. The following data are presented for each NNS component: a functional description, including preliminary performance requirements; a drawing and/or sketch of the component analyzed (when available); a summary of failure modes; and a discussion of each failure mode relative to their possible causes. This list will be used as the starting point for the component Failure Mode Analysis (FMA) work. (auth)

8136 (TID/SNA-1876) REDUNDANT SEAL AND CLAMP FOR THE NERVA NOZZLE TO REFLECTOR INTERFACE JOINT. Latin, E. (Aerojet Nuclear Systems Co., Sacramento, Calif. (USA)). 22 Sep 1970. 207p. Dep. NTIS $13.50.

A combined design effort was initiated to provide redundant seals and clamps at the NERVA nozzle to reflector joint, thereby eliminating the single failure mode associated with this interface. It was postulated that some condition or combination of conditions would result in pressure, thermal, ground handling or gravitation loading with sufficient potential to lift the reflector and core off the nozzle supporting surface and thus, allow fluid leakage between the reflector inlet plenum and nozzle chamber. Relaxation of the tension preload in the tie bolts could produce a similar potential leak path. Several design concepts to eliminate this potential single failure mode are described. This design study enumerates the step by step design process from original conception through evaluation, trade off, modification, and final selection of the Remotely-Operated V-band Clamp as the reference design for NSS-FDR. Two seals, both pressure operated, one Aeromega and the other a "K" seal are also incorporated to provide redundant sealing at this interface. (auth)

8137 (TID/SNA-1942) ENGINEERING OPERATIONS REPORT: EVALUATION OF THERMAL NETWORK SOLUTIONS AVAILABLE WITH THE SINDA COMPUTER CODE. Mockenhaupt, J. D. (Aerojet Nuclear Systems Co., Sacramento, Calif. (USA)). 29 Jul 1971. 16p. Dep. NTIS $4.00.

The SINDA-70 computer code offers a number of different solutions for transient thermal network problems. A brief survey study was conducted to establish some criteria for selection of the best execution routine for use in the transient thermal analyses required. The selection must consider possible trade-offs between solution accuracy and computer run time, as well as the size of the computer storage required. This study was undertaken because of accuracy problems previously encountered in some preliminary transient analyses for the nozzle extension effort. For the two sample problems considered, it was found that the full explicit transient solution gave accurate results for minimal computer time. It was possible, however, to reduce the computer time somewhat for the typical nozzle problem by taking large time steps with an implicit method. Relatively poor accuracy was obtained with the exponential prediction methods and hence their use is not recommended for the nozzle calculations. For steady-state problems, the network solution CINDSL, which requires the long pseudo-compute sequence (LPCS), was found to be the faster and more reliable. Recommendations for other particular problems are given. (auth)

8138 (TID/SNA-1943) ENGINEERING OPERATIONS REPORT: NOZZLE–NOZZLE EXTENSION JOINT CONCEPT NO. 30 STRESS ANALYSIS. Schumacher, J. G. (Aerojet Nuclear Systems Co., Sacramento, Calif. (USA)). 1 Mar 1972. 34p. Dep. NTIS $4.75.

A steady state stress analysis of the NERVA Nozzle to Nozzle Extension Joint Concept Number 30 is reported. This design consists of an AGCarb nozzle extension attached to an ARMCO 22-13-5 CRES nozzle by means of 120 clips. Two layup patterns were evaluated for the nozzle extension. For the 3 AGCarb failure modes checked (block tension, interlaminar shear, and warp compression), all margins were negative for the cylindrical wrap design and 2 were negative for the contoured wrap design. The nozzle flange (ARMCO 22-13-5 CRES) also shows a negative margin of safety in thermally-induced, hoop compression, based on an elastic analysis. Further analyses are required in the plastic range to determine the adequacy of the nozzle under thermal cycling. It is concluded that the Concept 30 joint design is structurally inadequate with the present status of materials test data. With a 25% improvement in minimum block tension strength and with consideration of nonlinear material stress-strain behavior, the Concept 30 design would probably become acceptable. However, it would be more desirable to reduce the over-all stress levels through design modifications which allow more freedom for thermal expansion of the nozzle extension, and reduce thermal gradients in the nozzle. (auth)

8139 (TID/SNA-2113) OPERATING CHARACTERISTICS AND REQUIREMENTS FOR THE NERVA FLIGHT ENGINE. Altseimer, J. H.; Mader, G. F.; Stewart, J. J. (Aerojet Nuclear Systems Co., Sacramento, Calif. (USA)). [nd]. 10p. AIAA, Sacramento, CA, member $1.00, nonmember $1.50.

Engine operational characteristics and requirements for typical missions are presented. These are illustrated in detail by a description of the lunar-ferry nuclear-module operations and requirements. The NERVA nuclear engine has unique conditioning, startup, and shutdown characteristics. In addition, it has a reactor cooldown requirement that is being studied to maximize its usefulness. Shutdown will include a 60% throttled thrust for an optimized period of time to minimize propellant consumption. The reactor life goal is ten hours. Steady-state performance is excellent for future high-energy missions. (auth)

8140 (TID/SNA-2272) NERVA PROGRAM. Instrumentation Data Book. (Aerojet-General Corp., Sacramento, Calif. (USA)). 1965. 537p. Dep. NTIS $30.00.

Declassified 12 Sep 1973.

This volume of the NERVA Instrumentation Data Book is devoted to Thermocouples and is complete with the development history, NERVA project experience (including references), NERVA requirements, manufacturer, type, etc. manufacturer's specifications and test results. The molybdenum sheath of many of these instruments failed at 4000°F (the eutectic point of molybdenum and carbon). Refractory insulation failed in other cases. In most cases, the failures occurred only during exposure at the more extreme conditions. (LTN)

8141 (WANL-PR(J)-037) WESTINGHOUSE ASTRONUCLEAR LABORATORY NERVA NUCLEAR SUBSYSTEM. Progress Report, 1 January 1965-31 March 1965. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 25 Apr 1965. 192p. Dep. NTIS $12.75.

Declassified 10 Sep 1973.

During this quarter the NRX-A3 reactor was completed and

shipped to NRDS. The trip was without incident; all instrumentation data recorded enroute was within normal limits. Much of the activity at the site consisted of preparation of the NRX-A3 and its associated equipment for the power test early in the next quarter. A study was performed on the fuel element corrosion rate as a function of nozzle chamber temperature to plan intermediate hold times which would not contribute significantly to NRX-A3 fuel corrosion. The corrosion rate as a function of fuel surface temperature was obtained from corrosion tests at WANL. Several modifications to the NRX-A3 test plan were issued for review. Work on the NRX/EST and XE-1 test plans continued; changes were made in accordance with the decision to use the NRX-A4 reactor in the EST test series. Activity in the NRX-A5 area was still largely at the component level. Orders were placed for long-lead time items and material specifications were revised to conform with NRX-A5 requirements. Concurrent with this effort, the program started in the last quarter to review all specifications to eliminate unnecessary requirements, to assure that present requirements are adequately covered, to minimize extra test material, and to provide more realistic rejection standards, was continued. (auth)

8142 (WANL-PR(J)-039) WESTINGHOUSE ASTRONUCLEAR LABORATORY NERVA NUCLEAR SUBSYSTEM. Summary Progress Report, 1 October 1964-30 September 1965. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 22 Oct 1965. 128p. Dep. NTIS $9.50.

Declassified 10 Sep 1973.

The major event in the NERVA Program during Contract Year 1965 was the series of NRX-A3 Power Tests at NRDS in Nevada. All objectives of the early plans were met. During EP-IV, the Full Power Test, a loss of liquid flow incident occurred. During the automatic changeover from liquid to gaseous hydrogen, the unplanned gaseous hydrogen flow caused the tie rod temperatures to increase excessively. Detailed examination disclosed that the reactor could be restarted and additional full power time could be accumulated. Later tests were successfully completed with no difficulties being encountered. A significant part of EP-VI was the fixed drum reactor transient test. While the possibility of rapid reactor startup with fixed drums had been considered for a number of years, the actual performance had to await a precise understanding of the reactivity effects of the reactor. The major reactivity contributions are reactor temperature coefficients and the opposing moderating effect of the hydrogen propellant. Nuclear calculations, critical experiment data, analysis of previous reactor test data, and digital and analog computer studies simulating the effect of the variations in density of the propellant and the results of the NRX-A2 low power tests provided sufficient confidence to conduct this test on the NRX-A3. The experimental results verified this possible mode of reactor operation. The next major activity is the NRX/EST Test Series. The NRX/EST test article is on hand and revisions to the test cell are completed or in process. Work continued on the NRX-A5, NRX-A6 and XE-I reactors. The major components for the NRX-A5 were on hand, including the control drums, outer reflector and inner reflector. Fuel for the NRX-A5 was in process at the Astrofuel Facility in Cheswick. The NRX-A6 reactor configuration was tentatively formulated and presented in design review meetings in May and June. The design presentation was documented in WANL-TME-1186. (auth)

8143 (WANL-TME-158) ESTIMATED POWER REQUIREMENTS OF THE REACTOR CONTROL SYSTEM. Morris, W. R. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 9 Oct 1962. 2p. Dep. NTIS $4.00.

The power requirements of the NERVA reactor control system are estimated to be between 1620 and 4440 watts, depending on the type of actuators. (LTN)

8144 (WANL-TME-178) RADIATION DATA REQUIREMENTS AT THE E-MAD FACILITY. Svasek, A. J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 26 Oct 1962. 3p. Dep. NTIS $4.00.

8145 (WANL-TME-282) EFFECT OF THERMAL NEUTRON SCATTERING MODELS ON POWER DISTRIBUTIONS IN KIWI-TYPE REACTORS. Stevens, C. A.; McCune, W. C. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Mar 1963. 9p. Dep. NTIS $4.00.

Declassified 11 Sep 1973.

The effect of the crystalline binding on thermal neutron scattering has been investigated, with emphasis on the effect on the eigenvalue and fission density in KIWI type reactors. Comparisons have been made for a gas model and more realistic crystal models, for both graphite and beryllium. (auth)

8146 (WANL-TME-291) NRX-A CONFIGURATION FOR RADIATION ANALYSIS. Capo, M. A.; Nassano, R. N.; Saltesz, R. G. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Apr 1963. 90p. Dep. NTIS $7.50.

Declassified 11 Sep 1973.

For purposes of radiation analysis, a standard NRX-A configuration was divided into 35 regions and the region volume, volume of each material, region weight, weight of each material, volume fraction, and density determined at room and operating temperatures. The pressure, temperature, and density of the hydrogen in each region was also taken into account. (LTN)

8147 (WANL-TME-428) RESONANT AND SHOCK RESPONSE CHARACTERISTICS OF THE NRX-A LATERAL SUPPORT SYSTEM. Stancampiano, P. A. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 15 Jul 1963. 24p. Dep. NTIS $4.25.

Declassified 10 Sep 1973.

The bulk dynamic responses of a radially-supported core subjected to a resonant forced vibration and a rectangular shock were investigated. Both displacement and force magnification responses were studied. The effects of coulomb friction and viscous damping were included, and quasi-static support responses to a diametrical slip of half the core were also studied. It was found that the NRX-A lateral support system cannot sustain a 4g resonant forcing function, but can sustain a 5g-10-millisecond shock. (auth)

8148 (WANL-TME-429) PRELIMINARY ANALYSIS OF FLOW OSCILLATIONS AND AERO-ELASTIC VIBRATIONS IN THE KIWI B-4A REACTOR. Bodenschatz, C. A.; DeZubay, E. A.; Morrison, H. L. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jul 1963. 70p. Dep. NTIS $6.50.

Declassified 10 Sep 1973.

The analyses presented involve the various reactor components which were considered as possible sources of the destructive vibrations encountered in the reactor core during the KIWI B-4A test of November, 1962. Primary emphasis was placed on developing mathematical models which could explain and aid in the understanding of pressure and flow oscillations which could couple with mechanical components of the reactor to initiate and sustain vibrations. In many cases, the mathematical models cited are being improved so that the more sophisticated solutions may provide a deeper insight into the actual behavior of aeroelastic instabilities. In all of the analyses, the results were applied to the geometry, design and start-up conditions of the KIWI B-4A reactor. The following areas were investigated for potential fluid flow and pressure oscillations: Flow schematic of entire engine, two-phase flow, vortex shedding, pressure oscillations within plenum chambers, nozzle resonance, and shock conditions at nozzle. Possible fuel element vibrations induced by gas flow have been grouped as follows: vibrations in parallel flow, and radial flow as a forcing function for vibrations. Some of the above areas investigated might be capable of producing oscillations or vibrations in the range of 20 to 33 cps comparable to the results of the KIWI B-4A tests. There were: flow schematic of entire engine, two-phase flow, and vibrations in parallel flow. (auth)

8149 (WANL-TME-587) NRX-A1 AND NRX-A2 INSTRUMENTATION ACCURACY REQUIREMENTS. Vetere, A. M.; Wisniewski, E. J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Oct 1963. 57p. Dep. NTIS $6.00.

Declassified 11 Sep 1973.

The accuracies desired for test data from the NRX-A1 and A2 reactors are listed. In general it appears that the obtainable accuracy of the test data will be consistent with that desired by the design groups, except for 5 pressure drop measurements in NRX-A2. The instrument types, locations and accuracy are given. (auth)

8150 (WANL-TME-671) EVALUATION AND TESTING OF STRAIN GAGE TECHNIQUES USED IN THE NRX-A1 REACTOR. Pappas, T. A.; Kalapaca, H. P. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 12 Feb 1964. 40p. Dep. NTIS $5.00.

The various factors which led to the choice of the strain gage techniques used in the NRX-A1 reactor are discussed including the strain gage circuitry, the gage type, and the bonding agent. Emphasis is placed on the test program conducted to evaluate the reliability of the Eastman 910 strain gage cement under simulated NRX-A1 environmental conditions. (auth)

8151 (WANL-TME-718) INFORMATION FOR NERVA TECHNICAL COMMITTEE MEETING OF MARCH 12, 1964. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 18 Mar 1964. 57p. Dep. NTIS $6.00.

Declassified 12 Sep 1973.

The Mechanical Test Program has subjected the reactor to

tests ranging from complete reactor vibration and shock tests through tests of each of the major subassemblies to tests of individual components. The full scale reactor vibration and shock tests have been extremely valuable in that they have: (1) Established the stability of the core under severe vibration and shock environments. In fact, the high frictional forces, which provide the core stability, have in turn generated tests to explore the possibility of core lockup under power operation. Various tests are currently being performed to explore this problem area. (2) Established that wear of graphite parts has been minimal; however, generation of graphite dust in these tests has required an evaluation of the effects of particle blockage of flow passages; and (3) Indicated need to redesign seal segments in order to eliminate chipping around the alignment holes in the present seal design. (auth)

8152 (WANL-TME-797) ANALYSIS OF SEVERAL NRX SYSTEM MALFUNCTIONS. Cleary, J. D. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). May 1964. 21p. Dep. NTIS $4.25.

Declassified 10 Sep 1973.

To supplement the Safety Analysis Report on NRX Testing (WANL-TNR-148), several additional possible malfunction possibilities of the NRX reactors and the test cell "A" coolant control system have been analyzed. There is still some question about a safe reactor shutdown from full power conditions with all 12 control drums fixed but it appears that a safe shutdown can be achieved in this condition from less than full power. The detailed results of the other possibilities are given: they can be compensated for by the instrumentation. (LTN)

8153 (WANL-TME-799) STATUS REPORT ON NRX SYSTEMS ANALYSIS MODELS. Thompson, R. E. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 27 May 1964. 39p. Dep. NTIS $5.00.

Declassified 10 Sep 1973.

The status of analog and digital models of NRX reactors and test facilities is discussed. Each of the models described has proven to be a valuable tool in NRX systems analysis. The relative advantages of each type of program are discussed: The digital model is more accurate and the analog model provides a good representation of dynamic operation. (LTN)

8154 (WANL-TME-1227) COMPRESSIVE MECHANICAL PROPERTIES OF FUEL ELEMENTS AT ELEVATED TEMPERATURES. Gesinski, L. T. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1965. 14p. Dep. NTIS $4.00.

Declassified 12 Sep 1973.

An investigation of the ultimate compressive strength of fuel elements as a function of temperature was conducted. A series of tests were performed on a group of two inch long fuel elements with maximum fuel loading (Code 99). The tests were performed over the temperature range of 3600°R to 5200°R. The maximum increase in ultimate compressive stress was approximately 33 percent of the ambient temperature (530°R) ultimate stress of 12,000 psi and occurred in the temperature range from 3800°R to 4000°R. At temperatures higher than 4600°R, the ultimate stress decreased rapidly and noticeable plastic deformation was observed. (auth)

8155 (WANL-TME-1242) CORE INSULATION THERMAL TEST. Kiefer, K. P. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Aug 1965. 26p. Dep. NTIS $4.50.

Declassified 12 Sep 1973.

The Core Insulation Development Program was initiated to investigate characteristics of pyrotile insulation as to bow, structural integrity, and thermal gradient when subjected to reactor temperatures and bundling pressures. All test parameters were met or exceeded, and specification pyrotile through NRX-A4 was proven to be satisfactory. Pyrofoil 0.010 inch thick was tested as a possible replacement for pyrolite. Ten layers forming an insulation barrier 0.100 inch thick satisfactorily withstood maximum reactor temperature and temperature differentials. (auth)

8156 (WANL-TME-1300) NERVA II SHIELD CONCEPTUAL DESIGN STUDY. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1965. 58p. Dep. NTIS $6.00.

Declassified 11 Sep 1973.

The heating rates in each propellant tank in either a single module unit, a triangular cluster of three modules, or an in-line cluster of three modules have been investigated. The resulting heating rates for both the shielded and unshielded cases are calculated. The heating in a triangular or in-line (far) clustered tank is 2500 and 1700 KW respectively with no shields. The 4200 pound top and extension shield would reduce the heating rates to 890 KW and 540 KW. The radiation levels at 10 feet from the center of the core for the several shielded and unshielded conditions are presented. The borated-beryllium oxide-aluminum shield gives essentially the same attenuation as the LiH-steel shield. However, additional shaping can improve the shield effectiveness. The radiation heating in the propellant tanks and its distributions are reported. The shield of the conceptual design differs from that used in the survey study in two respects, geometry and material. The conceptual shield is a flat, metal blank of aluminum drilled and filled with rods of borated beryllium oxide. The extension consists of an aluminum annulus drilled and filled with rods of borated beryllium oxide which is bolted to the top shield. The flexible design of this shield offers the advantage of a removable or bolt-on extension to the top shield that may be used in clustered configurations or top shield which may be used for single modules alone. The construction also allows the choice of several neutron shield materials. These materials could be used throughout the shield or selectively used in various regions of the shield for local special, or tailored, shielding requirements. The basic flat shield may be shaped radially by varying the density or volume of materials used to fill the drilled holes, or by machining the forward surface of the aluminum. (auth)

8157 (WANL-TME-1313) NRX-A6 FUEL DEVELOPMENT PROGRAM. Boltax, A. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Oct 1965. 37p. Dep. NTIS $5.00.

Declassified 11 Sep 1973.

Research programs aimed at producing fuel elements which will last 60 minutes in NRX-A6 are described. Included are hydrogen corrosion tests, coated fuel particles, permeability, additives, pyrolytic carbon, metal carbides, processing methods, joints, etc. (LTN)

8158 (WANL-TME-1318) NOTES OF MONTHLY DEVELOPMENT TEST PROGRAM REVIEW MEETING HELD WITH SNPO AT WANL ON OCTOBER 22, 1965. (Westinghouse Electric Corp., Pittsburg, Pa. (USA). Astronuclear Lab.). 12 Nov 1965. 34p. Dep. NTIS $4.75.

Declassified 11 Sep 1973.

8159 (WANL-TME-1329) A. FUEL PARTICLE EVALUATION AND COATING DEVELOPMENT. B. EXPERIMENTAL INVESTIGATION OF FISSION PRODUCT RELEASE. Feild, A. L. Jr.; Grandy, G. L. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 19 Nov 1965. 51p. Dep. NTIS $5.75.

Declassified 11 Sep 1973.

The use of selected additives, co-deposited with a pyrolytic carbon (PyC) coating on UC_2 fuel particles, appears to have the potential of raising by 100°–200°C the maximum exposure temperature of particles for times up to 1 hour. The work is of a preliminary nature, and was conducted in a small laboratory apparatus. Of necessity, scale-up factors must be investigated to determine applicability on a reasonable production basis. The laboratory effort has demonstrated that a closer degree of control and a more expensive coating operation will result from use of the additive technique, than from use of the conventional PyC coating methods. From experimental evidence it appears doubtful that Al can be incorporated satisfactorily in PyC coatings by vapor deposition using the fluidized bed. However, Zr can be deposited in desirable quantities with a fairly reproducible behavior. Although a large number of runs were made (44) in the Zr investigation, more work on controlling the $ZrCl_4$ addition and a study of the kinetics of the system $CH_4-ZrCl_4-H_2$ are necessary. Release fractions for various nuclides were found to be a complex function of time after an initial burst. The release rates of other nuclides studied were linear with time and did not exhibit the initial burst effect. However, at 2200°C a drastic increase in release was noted in samples heated longer than 20 minutes. The nuclides included in this group are ^{144}Ce, ^{137}Cs, ^{91}Y, ^{131}I, and ^{129}Te. (auth)

8160 (WANL-TME-1330) HHT-7 TEST REPORT No. 2. Cherish, P.; Painter, W. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jan 1966. 113p. Dep. NTIS $8.75.

Declassified 11 Sep 1973.

Post test examination of the graphite material from reactors tested to date has revealed that the rate of corrosion of the graphite at high temperatures will be one of the primary factors limiting the life of current reactor designs. In order to increase the life of current reactors it is necessary to understand corrosion behavior. In an effort to study peripheral core corrosion, a test program was initiated to design, fabricate, and test a small diameter filler strip test model having compound components representative of the current reactors. The first phase of this program is to determine whether the concept of using a small diameter, complex core model is feasible for demonstrating corrosion behavior

representative of the corrosion in the peripheral core region of the reactors. The second phase of the test program depends primarily on the success of meeting the first phase objective and will be directed toward the evaluation of proposed peripheral core designs by qualitative comparison tests employing different model configurations. (auth)

8161 (WANL-TME-1373) ENGINEERING MECHANICS LABORATORY TESTING OF CORE SUPPORT BLOCK. Progress Report. Watjen, E. A.; Spofford, N. P. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Feb 1966. 41p. Dep. NTIS $5.25.

Declassified 10 Sep 1973.

The cracking of support block seats came to light after a detailed post-test inspection of the NRX-A3 reactor revealed pockets of corrosion in the counterbore seat area. Many of the regular and irregular support blocks sectioned at the test site were found to have circumferential cracks in the seat area near the 0.02 inch radius. These cracks expose uncoated graphite to the hydrogen atmosphere, and thus corrosion takes place. This reaction could affect the load bearing area of the support block and restrict the operating interval of the reactor. A four part testing program instituted to solve this problem is described. (auth)

8162 (WANL-TME-1377) EVALUATION OF NEW GRAPHITES FOR NERVA SUPPORT BLOCKS. Kachur, V. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). [nd]. 59p. Dep. NTIS $6.00.

Declassified 10 Sep 1973.

NERVA support blocks are structural components which provide an axial retaining base for the fueled graphite elements comprising the reactor core. These blocks, now machined from molded ATJ premium structural graphite, are required to withstand the high operational temperature and corrosive action of hydrogen (NERVA exhaust gas). In this respect, the support blocks are critical components. Obviously, the blocks must be fabricated from the most appropriate structural graphite for this exacting function, and be adequately coated to provide the necessary life expectancy. The possible use of high-expansion grades of premium structural graphite has been examined as a means of improving strength and eliminating the intermediate-temperature corrosion associated with the current ATJ NERVA support blocks. The following materials, listed in the order of increasing thermal expansion, were investigated. Unfueled NERVA element extrusion, ATJ (control), P-03, L-56, EP-192-CH, EP-192-C, and EP-192. Grade L-56 provided the closest match in thermal expansion with that of the protective niobium carbide coating. All of the high-expansion graphites could be readily coated with an adherent, crack-free layer of NbC. When exposed to the high rates of transient heating and cooling during the hydrogen corrosion test, these graphites tended to fail by crack formation on the surface. It is concluded that support blocks machined from high-expansion graphites would be susceptible to thermal shock under the present reactor operating conditions. The mechanical and thermophysical properties of the high-expansion grades are surveyed in the Appendix. (auth)

8163 (WANL-TME-1379) NRX REACTOR DESIGN PRESENTATION. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 9 Feb 1966. 49p. Dep. NTIS $5.50.

Declassified 10 Sep 1973.

8164 (WANL-TME-1382) FRICTION AND WEAR TESTS OF NRX-A5 CORE PERIPHERY COMPONENTS. Morgan, L. P. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Feb 1966. 16p. Dep. NTIS $4.00.

Declassified 10 Sep 1973.

Specimens of NRX-A5 core periphery components were tested on pyrotile to determine the friction forces and wear that would occur during reactor assembly and 10 reactor test runs of 10 minute duration. The specimens were subjected to 10 simultaneous temperature and motion cycles that simulated reactor startup, operation, and shutdown conditions. The tests were performed in hydrogen at temperatures from 530°R to 4300°R and contact pressures from 4 psi to 150 psi. No significant damage of contact surfaces of the uncoated or niobium carbide-coated core periphery component specimens was observed in the post-test visual inspections. However, corrosion of the pyrotile specimens contact surfaces was observed in the tests conducted at 4170°R and 4300°R. Projection of the observed weight loss to reactor operating conditions indicated that the corrosion of the pyrotile in the reactor test runs should be within the previously calculated values. The static coefficient of friction values measured varied from 0.10 to 0.93 and were within the range of values used for functional and stress analyses. Significant damage of the paint sprayed zirconium carbide coating originally proposed for the filler strips was observed in preliminary testing. (auth)

8165 (WANL-TME-1512) NERVA NUCLEAR SELF DESTRUCT SAFETY COUNTERMEASURE. Call, D. W. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 30 Sep 1966. 42p. Dep. NTIS $5.25.

Declassified 10 Sep 1973.

A self induced nuclear excursion may be a feasible way to effect NERVA destruct. However, before any firm definition of either destruct requirements or a destruct system can be made, the following areas require investigation: The degree of destruct desired to offer adequate safety to the earth's populace needs further analysis and definition; existing excursion models need to be improved to treat such effects as bead rupturing effecting fission product release, reactor disassembly, post operational reactor characteristics; and additional studies are needed with regard to the feasibility of reactivity introduction from the point of view of reactor design. (auth)

8166 (WANL-TME-1540) MEASUREMENT OF FISSION PRODUCT LOSS DURING NRX-A5. Rymer, G. T.; Henninger, W. A.; Grandy, G. L. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Dec 1966. 95p. Dep. NTIS $7.75.

Declassified 10 Sep 1973.

One of the objectives of the fission product diffusion program was to describe the release of fission products from the NERVA reactor during normal operation. The computer program FIPDIF was developed to describe the fission product release during normal operating conditions. The experimental work directed toward the provision of data for refinement of the FIPDIF Code is described. The principal experiment was radiochemical analysis of the effluent clouds from the full power operation of NRX-A5, together with post-mortem radiochemical analysis of fueled and non-fueled elements from this reactor. The effluent sampling techniques and results are described, and measured and calculated fission product release data are compared. (HDR)

8167 (WANL-TME-1551) NR-1 SIZING PARAMETER STUDY. Retallick, F. D. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 2 Dec 1966. 19p. Dep. NTIS $4.00.

Declassified 10 Sep 1973.

8168 (WANL-TME-1552) NOTES OF MONTHLY DEVELOPMENT TEST PROGRAM REVIEW MEETING HELD WITH SNPO AT WANL ON NOVEMBER 16, 1966. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Nov 1968. 51p. Dep. NTIS $5.75.

Declassified 10 Sep 1973.

8169 (WANL-TME-1674) NRX-A6 FUEL ASSESSMENT PROGRAM. Report of Supplementary Phase-I Electrical Tests, Characterization of NRX/EST and NRX-A5 Elements. Phase I-2A, Phase I-2B, Phase I-2D, Phase I-4A. Guzek, J. C. (ed.). (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1967. 263p. Dep. NTIS $16.25.

Declassified 12 Sep 1973.

The investigations of certain NRX/EST and NRX-A5 fuel element corrosion characteristics in the electrical resistance furnace tests are reported. Briefly, these investigations showed: the capability of the electrical furnace corrosion tests with external element pressure lower than bore to discern relative fuel element coating batch performance (good from bad); the mitigating effect of combined low loading and external coating on element corrosion, but could not establish effect of loading variation on corrosion; the deleterious effects of higher levels of power and flow rate on NRX-A4 and A5 type fuel element corrosion; and an electrical resistance furnace corrosion screening test, based on NRX-A4 and A5 reactor fuel element behavior, in which reasonably similar bore corrosion characteristics existed between reactor and electrical testing. (auth)

8170 (WANL-TME-1784) METAL TUBE BORE INSERTS. Kochka, E. L. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 23 Apr 1968. 35p. Dep. NTIS $4.75.

Declassified 11 Sep 1973.

The use of metal tube liners is designed to improve the corrosion performance of fuel elements by providing a barrier between the hydrogen coolant flow and open cracks in the coating in the "mid-band" region. The preparation of tube-lined elements consists of cutting the tubing to the proper length, inserting it from the cold end of the element over the niobium carbide coating so that it terminates beyond the mid-band region of the element, and locking or sealing the tube in place. Only niobium and molybdenum were considered as potential materials for tube-lining elements. Thin wall niobium tubing was easily cut to length with cutting pliers, scissors, or razor-edged knives but the avail-

able molybdenum tubing was brittle and often split during cutting or forming. (auth)

8171 (WANL-TME-1797) NOTES OF MONTHLY DEVELOPMENT TEST PROGRAM REVIEW MEETING HELD WITH SNPO AT WANL ON MAY 1, 1968. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 20 May 1968. 56p. Dep. NTIS $6.00.
Declassified 11 Sep 1973.

8172 (WANL-TME-1810) RADIOCHEMICAL ANALYSIS OF NRX-A6. Henninger, W. A.; Rymer, G. T.; Roesmer, J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jun 1968. 43p. Dep. NTIS $5.25.
Declassified 11 Sep 1973.
The results of radiochemical analysis made on samples of the NRX-A6 reactor effluent and samples of selected fuel element slices are described. These analyses were made to determine and document the total amount of fission product release from the reactor, evaluate a new system of effluent sampling designated the "elephant gun", and provide experimental measurement of fission product release with which to test the validity of WANL source term prediction capabilities. The NRX-A6 reactor was operated at full power for 60 minutes. The first of the above objectives was met by fuel element sample analysis. Measurement of 50 fuel element slices, 10 from each of 5 separate fuel elements, indicate that 4.0×10^6 curies or .83% of the total gross gamma inventory was released. The second objective of elephant gun evaluation was not a complete success since samples were obtained for only the first 20 minutes of the run. Analysis of these canister samples which were collected, however, is consistent with the fuel sample analysis. The elephant gun samples also provide differential release rates of the various nuclides which is a worthwhile supplement to the total release determined by the fuel analysis. The third objective of testing the validity of the source term prediction is achieved by comparison of a FIPDIF Code calculation of release with the measured release. All calculated iodine and gross gamma source terms are within the range of uncertainties in the measured releases. (auth)

8173 (WANL-TME-2749) COOLDOWN AND THRUST NULLING REQUIREMENTS. Trade Study No. 703/704. Data Item S-54. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Feb 1971. 177p. Dep. NTIS $12.00.
Declassified 11 Sep 1973.
A trade study performance evaluation of five cooldown and two thrust nulling systems was made on the NERVA NSS hot bleed cycle. Three of the five cooldown systems were tank pressure fed. They are (1) normal cooldown using on/off pulsing of the reactor, (2) independent pulsing of flow to the structural support and reflector paths, and (3) the use of ullage gas with either (1) or (2). Two auxillary pumped systems were analyzed, one having parallel flow to the structural support-reflector and other having series flow. The two thrust nulling systems were zero-thrust, radially-directed coolant and thrust-balanced, axially-directed coolant. Each cooldown and thrust nulling system combination was compared on each of ten weighted parameters in the comparison matrix. The pressurized systems were shown to lose their performance advantage at power levels below 15-20 MW. As a result, the independent pulsing of flow to the structural support and reflector paths known as Pulsed-on-Separate-Limits, or POSL, was selected in combination with radial thrust nulling. (auth)

8174 (WANL-TMI-243) OPERATING INSTRUCTIONS FOR TWO IBM PROGRAMS FOR TRI-AXIAL ELASTIC THERMAL STRESSES. Kallin, I. N. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 20 Oct 1962. 19p. Dep. NTIS $4.00.
The procedure is given for using two IBM programs which were set up to solve for the thermal stress in a long unrestrained member having a constant cross section provided that the temperature is known at all points in the cross section. (auth)

8175 (WANL-TMI-257) EFFECTS OF TEMPERATURE ON A KIWI B-5 SHIELD CAPSULE PLUGGED WITH MAGNESIUM OXIDE. Schreiber, J. J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 19 Sep 1962. 4p. Dep. NTIS $4.00.
The compatibility of lithium hydride and magnesium oxide at high temperatures was investigated. No changes were observed when the two compounds were heated in helium to 650°F. When heated in air the LiH flashed at 630°F and continued to burn when removed from the heat source. (LTN)

8176 (WANL-TMI-258) BELLOWS SEAL, KIWI B-5 SHIELD. Schreiber, J. J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 19 Sep 1962. 7p. Dep. NTIS $4.00.
The control of gases by the use of seals is an integral part of the reactor design. Because of the high temperatures associated with reactors many commercial materials are not suitable as a sealing material. Various mechanical designs have been proposed which would eliminate the need for special sealing materials. An investigation of a mechanical seal design which consisted of a bellows placed on a mounting plate with the contacting surfaces ground to a 32 μ inch finish is reported. The results are encouraging and more extensive tests are planned involving off-center loading, vibration and temperature variations, etc. (auth)

8177 (WANL-TMI-259) 1.5% BORON, STAINLESS STEEL. Schreiber, J. J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 19 Sep 1962. 12p. Dep. NTIS $4.00.
Borated steel of the form and quality to be used in the KIWI B-5 shield capsules was tested to verify its reported brittleness. The material behavior was classified as being definitely ductile at both room and liquid nitrogen temperatures. (auth)

8178 (WANL-TMI-267) REQUEST FOR HOT CELL SERVICES. Calley, H. W. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 21 Sep 1962. 9p. Dep. NTIS $4.00.
The requirements of a post-irradiation inspection of bearing components are listed (weight, visual and photographic examination, dimensions, hardness, metallography, friction, etc.). (LTN)

8179 (WANL-TMI-268) WANL PULSE PRE-AMPLIFIER. Obusek, E. J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 21 Sep 1962. 7p. Dep. NTIS $4.00.
The WANL pulse pre-amplifier was designed for matching a long (60 ft) co-axial cable to a fission counter of fast rise time and short decay time pulse output. The rise time of the final design exceeds 0.02 μsec and it shapes a pulse for short decay time which permits a high counting rate. The pre-amplifier requires a well regulated filament supply. A radiation-resistant pre-amplifier was built and tested. It showed no change in pre-amplifier characteristics after four (4) hours at 1 MW reactor power. (auth)

8180 (WANL-TMI-269) CAPSULE THERMAL SHOCK TEST. Schreiber, J. J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 21 Sep 1962. 1p. Dep. NTIS $4.00.
The effects of thermal shock on a KIWI B-5 shield capsule filled with lithium hydride pellets were investigated. The capsule was heated uniformly to 1000°R (540°F) and then immersed in the liquid nitrogen bath. After cooling the capsule was inspected with a 3X stereomicroscope. This cycle was repeated six times. No cracks or leaks were observed after completion of each cycle. (auth)

8181 (WANL-TMI-762) SEAL SEGMENT VIBRATION TEST. Zibritosky, G.; Morin, D. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 6 Aug 1963. 4p. Dep. NTIS $4.00.
To determine the amount of wear resulting from relative motion between seal segments and mating components, a spring preload of 40 lbs. was applied between the lateral support pin and the seal segment. The load alternated between 40 lbs. at minimum displacement and 61.5 lbs. at a maximum displacement of 0.100 inch. After 105,000 cycles of operation the test apparatus was disassembled and components were again observed and measured. The wearing action produced on the components could not be measured with micrometers; however, areas of contact during relative motion were polished. The polished surfaces appeared at areas marked "W" on the sketch. In addition, white blotting paper was used to wipe off the lateral support pins and interior surface of hole in the main segment to pickup any graphite particles which may have been a result of the wear process. The procedure did not show any evidence of graphite wear particles. (auth)

8182 (WANL-TMI-766) LATERAL SUPPORT MACHINE SCREW TORQUE TEST. Parsons, L. E. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 12 Aug 1963. 13p. Dep. NTIS $4.00.
The lateral support springs are fastened to the graphite barrel by means of an aluminum bracket and two 5/16-24 aluminum machine screws. Room temperature static tests were conducted to determine the torque that should be applied to these screws during reactor assembly. The maximum allowable torque the internal graphite threads will carry is approximately 60 inch-pounds. The recommended assembly torque is 30 to 40 inch-pounds. Tests indicated that the quality of the bolt threads has a noticeable effect on the strength of this size internal graphite threads. (auth)

8183 (WANL-TMI-772) FCX ELEMENT LOAD TEST. Zibritosky, G.; Lancaster, R. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 15 Aug 1963. 3p. Dep. NTIS $4.00.

To determine whether fuel clusters may be removed from the FCX core by applying load to the cluster bolts, load bars were threaded 1¼ inches into each end of fuel cluster specimens and then the assembly was placed in a tensile testing machine. The specimens were loaded at a slow uniform rate until failure occurred. The average rupture load for the 10 specimens 707 pounds, ranging from 606 pounds minimum to 814 pounds maximum. (auth)

8184 (WANL-TMI-789) PRESSURE RELIEF HOLES IN NOZZLE END OF INNER REFLECTOR. Miller, A. I. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 3 Sep 1963. 1p. Dep. NTIS $4.00.

Radial pressure relief holes are to be drilled at the nozzle end of the inner reflector to relieve the pressure on the low pressure side of the nozzle flange-inner reflector interface seal. These holes must be sized for a low pressure ratio to minimize the barrel lift-off and the leakage exit velocity. It was determined that there should be 24 holes, 0.100 inches in diameter, located symmetrically around the circumference. At 100% power, this results in a calculated leakage flow rate of approximately 0.06 lbs/sec with a pressure ratio of 1.002 across the relief holes. (auth)

8185 (WANL-TMI-790) VISCOUS COMPRESSIBLE FLUID FLOW IN A NETWORK OF NARROW CHANNELS. Warner, P. C. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 4 Sep 1963. 7p. Dep. NTIS $4.00.

In estimating the pressure distribution for compressible fluid flow in long, very narrow channels formed by gaps between identical prismatic rods, it is important to realize that there is a range of channel thickness below which the flow is controlled by viscous shear stresses in the fluid rather than by conversion of pressure head to velocity head (for any given circumstances it is rather simple to calculate the flow under both assumptions, the lesser flow being the better approximation to the true flow). This shear stress-controlled range is of importance since there can be an appreciable time lag from the time a flow channel reaches a certain configuration and the time the equilibrium pressure distribution for that configuration arrives. This time lag, of course, implies the possibility of self-excited vibrations of the fluid flow-mechanical system. While the prismatic rods are discrete and have discrete flow paths around and along them, in the case where there are a large number of such rods we would seem to be justified in the assumption of an infinite number of rods, hence the use of distributed properties. Such a model can, of course, offer calculation advantages. (auth)

8186 (WANL-TMI-793) PROPOSED EFFLUENT MONITORING PROGRAM FOR NRX REACTOR TESTS. Calley, H. W. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 30 Sep 1963. 39p. Dep. NTIS $5.00.

Full-scale static testing of the NRX-A series of NERVA reactors will be conducted at the Nuclear Rocket Development Station (NRDS) at the Nevada Test Site. A program for monitoring the radioactive effluent and evaluating the potential environmental contamination which might result from the NRX-A series of tests is proposed. The monitoring program, based on techniques developed by the Los Alamos Scientific Laboratory (LASL) during KIWI tests, consists of comprehensive sampling and analysis of the radioactivity released and deposited within a 2.5-mile radius of the reactor being tested. The characteristics of the radioactive effluent are determined by identifying released radioisotopes, determining the average size of the effluent particulates and by measuring the concentration of nuclides present in the samples that are collected. The sampling network, type of samples, and sampling equipment as well as the types of data and possible methods of analysis are also discussed. (auth)

8187 (WANL-TMI-804) CORE ORIFICING PROGRAM DATA REQUIREMENTS. Killinger, A. H. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 20 Sep 1963. 34p. Dep. NTIS $4.75.

A series of computer programs to select the proper orifice size for individual fuel element channels is described. A large amount of tabular data is used and this is checked for errors by parabolic interpolation and plotting. The data involves the nuclear characteristics required for each fuel element position and the physical and nuclear characteristics of the available fuel elements. (LTN)

8188 (WANL-TMI-823) TEST CELL "A" TURBO-PUMP TEMPERATURE. Brunot, W. K. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 2 Oct 1963. 2p. Dep. NTIS $4.00.

The liquid hydrogen temperature in the test cell "A" Dewars has been taken as 44°R in various calculations. On the basis of actual Sanborn recordings the pump inlet temperature should be taken as 41.0°R at a flow rate of 30 lbs/sec and 39°R at a flow rate of 60 lbs/sec. (LTN)

8189 (WANL-TMI-832) LOAD VS. DEFLECTION CHARACTERISTICS FOR INSTRUMENTED AND NON-INSTRUMENTED LATERAL SUPPORT SPRINGS. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 14 Oct 1963. 7p. Dep. NTIS $4.00.

Load vs deflection characteristics were obtained for non-instrumented and instrumented support spring assemblies. The average spring constant based on the loading cycles for the instrumented spring assembly is approximately 6.5% lower than the non-instrumented assembly. At a deflection of 0.450 in., the stress in the instrumented spring is approximately 180,000 psi based on the assumption that the modulus of elasticity is 30×10^6 psi and that a linear relationship between stress and strain occur over the load range of the test. There was no apparent permanent set of either of the two assemblies investigated. A hysteresis effect is present in each assembly between the load and unload cycle. Since the measured strain in the spring is extremely high, some concern should be given to the effect on life of the springs under small cyclic deformations superimposed on the high initial load. Therefore, it is strongly recommended that fatigue tests on the springs be conducted at –320°F, simulating the anticipated amplitudes of motion. (auth)

8190 (WANL-TMI-1038) CALCULATION OF DIFFERENTIAL AND INTEGRAL ABSORPTION IN CONTROL VANE FROM CMC FLUX VALUES ON AND IN VANE. Drawbaugh, D. W. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 16 Apr 1964. 7p. Dep. NTIX $4.00.

8191 (WANL-TNR-042) MODE OF FAILURE ANALYSIS SUMMARY. NERVA B-2 Reactor. Neal, R. A. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 9 Mar 1962. 35p. Dep. NTIS $4.75.

Declassified 10 Sep 1973.

In the preliminary design phase of the NERVA reactor, several basically different designs have been considered. One of these contains a bottom supported core and is identified as the NERVA B-2 reactor design. Because of this importance of reliability, a failure mode analysis of the NERVA B-2 reactor design was considered desirable. The results of the failure mode analysis are presented and areas in which design changes may be made to improve the reliability of the design are indicated. (auth)

8192 (WANL-TNR-050) ADVANCED REACTOR STUDY, PHASE 1: NERVA NUCLEAR SUBSYSTEM. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Mar 1962. 144p. Dep. NTIS $10.25.

Declassified 10 Sep 1973.

The power capability of advanced reactors based on the Los Alamos PHOEBUS concept was examined in order to guide the development of the NERVA reactor and to understand its growth capabilities. The LASL KIWI-B4 reactor geometry was modified by replacing the graphite reflector cylinder with additional fuel element clusters and its power capability determined. The design was then analyzed to identify the major problem areas. Detail design approaches were prescribed to overcome structural cooling problems in the most critical areas. An alternative to the rod core support structure was developed which appeared theoretically to have a large development potential. This design employed a cooled metal support plate at the outlet end of the core. It was recommended that analytical and experimental work be performed to further evaluate this design. (auth)

8193 (WANL-TNR-062(Pt.1)) LAMINAR FLOW INSTABILITIES. Part I. DeZubay, E. A. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). May 1962. 23p. Dep. NTIS $4.25.

Declassified 10 Sep 1973.

The problem of laminar instability, defined as multivalued flow for a given pressure drop, is considered from its basic derivations. The conditions under which such flows can occur are determined and recommendations for future analytical and experimental work are suggested. The calculations of the solutions of the general pressure drop equation obtained indicate the following conclusions: The laminar instability condition is very sensitive to the high temperature transport and thermodynamic properties of the gas; and the hydrodynamic assumptions used in obtaining the classic solutions of laminar flow must be re-examined very critically in the light of the flow conditions existing in the range of the suspected instabilities. (auth)

8194 (WANL-TNR-078) KIWI B-5 SHIELD. Volume III. Thermal Design and Analysis. Black, D. L.; Rieke, K. L. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 28 Dec 1962. 109p. Dep. NTIS $8.50.

Declassified 10 Sep 1973.

The thermal and fluid flow design characteristics expected from the KIWI B-5 heated-bleed-cycle shield (NERVA prototype) are reported. The Mechanical Design and the Radiation Shielding analyses are presented in Volume I and Volume II respectively. A brief review of the shield design development from conceptual studies to the final configuration is presented. The shield is located directly above the reactor entirely within the pressure vessel. The final KIWI B-5 shield is a three pass design, approximately 63% lithium hydride, 25.5% stainless steel, 1.5% natural boron and 10% void in composition. The shielding material in the form of pellets is encapsulated in stainless steel tubes arranged in triangular array with coolant flowing in the void area between the tubes. The results of a radial flow distribution analysis are presented including the effects of variable channel length and hydraulic diameter, variable plenum static pressure, and power distribution. Temperature distribution in a representative capsule in each pass is given for nominal and hot channel operating conditions. The results of three methods of analysis are compared for the third pass capsule. Support plate temperatures and flow baffle design are also reported. (auth)

8195 (WANL-TNR-107) VIBRATION TEST OF AN ELECTROPNEUMATIC ACTUATOR, GENERAL ELECTRIC MODEL 7T-AG14-A01. Snarponis, W. J.; Sipe, F. A. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 8 May 1963. 28p. Dep. NTIS $4.50.

Declassified 10 Sep 1973.

A General Electric Electro-Pneumatic Actuator was vibrated so that the effects of limited vibration on the actuator performance could be studied. The actuator performance and the physical structure of the actuator were not adversely affected by a vibration force of 5 g's within the frequency range of 20 cps to 2000 cps. The actuator had significant resonant frequencies of 270 cps, 740 cps, 1600 cps and 1900 cps in the horizontal plane and 1000 cps in the vertical plane. Small changes in the output waveshape were evident at the resonant frequency of 1000 cps. This change was small and did not affect the characteristic performance of the actuator. (auth)

8196 (WANL-TNR-115) ASSEMBLY PROCEDURES, NRX-A1. Zwillich, A. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jun 1963. 141p. Dep. NTIS $10.25.

Declassified 10 Sep 1973.

The procedures to be followed and the equipment to be used in assembling the NRX-A1 Cold Flow Reactor are described. The sequence of operations to be followed during assembly is listed and additional documentation and other relevant supplementary information required is identified. (auth)

8197 (WANL-TNR-132) FUEL ELEMENT BINDER STUDIES. Yeoman, F.; Boltax, A. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 20 Sep 1963. 52p. Dep. NTIS $5.75.

Declassified 10 Sep 1973.

The proprietary furfuryl alcohol resin used by the Astrofuel Facility as a graphite bond in the manufacture of extruded fuel elements was studied from the quality control viewpoint to determine what characteristics of the resin must be controlled in order to assure uniform trouble-free performance during processing of fuel elements and a final product of acceptable quality. Acceptance criteria for the resin based on measurement of solids content, viscosity, gel time, pH, and boron content were established and test methods for these determinations were specified. A program for modification of the furfuryl alcohol resin system to expedite production of fuel elements and to improve quality of the product is described. (auth)

8198 (WANL-TNR-160) EVALUATION OF A MANUFACTURING PROCESS FOR PRODUCING PYROLYTIC GRAPHITE INSULATING SLEEVE OF MAXIMUM STRUCTURAL INTEGRITY. Blay, J. S. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 1964. 24p. Dep. NTIS $4.25.

Declassified 10 Sep 1973.

An evaluation was made of a new concept manufacturing process for producing an insulating sleeve of maximum structural integrity. One furnace run consisting of 50 Tapered Wall As-Deposited Pyrolytic Graphite Bats deposited to a 9" length, yielded without any O. D. or I. D. machining, 46 functionally usable insulating sleeves. No delaminations intersected either unmachined surface, thermal conductivity appeared to be adequately low, and brushing and component vibratory testing established that this high yield processed sleeve is of maximum physical integrity. Manufacturing and Supplier Cost estimates indicate that this manufacturing process should result in a substantial cost reduction. (auth)

8199 (WANL-TNR-178) NERVA SOURCE TERM PROGRAM. Brown, W. S. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1964. 141p. Dep. NTIS $10.25.

Declassified 11 Sep 1973.

The Source Term Program is concerned with obtaining and correlating all information pertaining to the radiological hazards resulting from the re-entry and earth impaction of radioactive materials generated during flight operations of a NERVA-type nuclear rocket engine. The analytical studies and experimental findings of work performed under the ROVER Flight Safety Program are summarized in the following areas: fission product generation and decay in the reactor fuel, diffusion of fission products at high fuel temperatures, neutron activation of NERVA engine materials, re-entry oxidation and ablation reactor fuel and structural materials, engine destruct systems for use as a safety countermeasure, biological hazards produced by re-entering core fragments, and application of digital computer programs for hazards evaluation of flight missions. (auth)

8200 (WANL-TNR-219) NRX-A5 REACTOR TEST ANALYSIS REPORT. Knecht, W. L. (ed.). (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Mar 1967. 588p. Dep. NTIS $32.50.

Declassified 10 Sep 1973.

Two full power endurance tests were performed during the NRX-A5 series, which involved a total of 30.1 minutes above 3700°R chamber temperature. One run involved a fixed control drum startup, which was extremely smooth. The comparisons of test data with predicted values was good. Fuel element corrosion was 27 g per element. The reactivity loss increased exponentially with elapsed time at full power. Radiation dosimetry and radiation heating measurements are reported. Extensive analyses were made of this test and of previous test results. (LTN)

8201 PROSPECTS FOR THE USE OF SMALL NUCLEAR POWER PLANTS AT GEOLOGICAL EXPLORATION SITES. Limitovskii, A. M. (Moscow Geological Exploration Inst.). Izv. Vyssh. Ucheb. Zaved., Geol. Razved.; No. 12, 163-166 (Dec 1974). (In Russian).

The advantages in the use of small nuclear power plants at remote geological exploration sites are briefly summarized. The operational principles of nuclear power plants are reviewed, and the requirements of a plant for use at exploration sites are tabulated. The design of the "Sever" nuclear power plant is described. It is a water-water reactor with location of the reactor and steam generator in one vessel, natural circulation of the coolant in both circuits, and self-regulating power in conformance with the heating of the turbogenerator. (JSR)

Reactor Safety and Environmental Aspects

Refer also to abstracts 6094, 6097, 6342, 6345, 6405, 6406, 6424, 6425, 6441, 6460, 6462, 6469, 6472, 6473, and 6789.

8202 (ANCR-1196) EXPERIMENT DATA REPORT FOR SEMISCALE MOD-1 TESTS S-01-4 AND S-01-4A (ISOTHERMAL BLOWDOWN WITH CORE RESISTANCE SIMULATOR). Zender, S. N.; Jensen, M. F.; Sackett, K. E. (Aerojet Nuclear Co., Idaho Falls, Idaho (USA)). Mar 1975. Contract AT(10-1)-1375. 287p. Dep. NTIS $10.60.

Recorded test data are presented for Tests S-01-4 and S-01-4A of the semiscale Mod-1 isothermal blowdown test series. These tests are among several semiscale Mod-1 experiments which are counterparts of the planned Loss-of-Fluid Test (LOFT) nonnuclear experiments. System hardware is representative of LOFT design based on volumetric scaling methods, and initial conditions duplicate those identified for the LOFT nonnuclear tests. Tests S-01-4 and S-01-4A employed an intact loop resistance that was similar to that of Test S-01-3 and low relative to that of Test S-01-2. An orificed structure was used in the pressure vessel to simulate the LOFT core simulator. The tests were initiated at initial isothermal conditions of about 2250 psig and 540°F by a simulated offset shear of the cold-leg broken-loop piping. During system depressurization, coolant was injected into the cold leg of the intact loop to provide data on the effects of emergency core cooling on system response.

Following the blowdown portion of Test S-01-4, coolant spray was introduced into the pressure suppression tank to determine the response of the pressure suppression system. The uninterpreted data are presented. The data, presented in the form of graphs in engineering units, have been analyzed only to the extent necessary to assure that they are reasonable and consistent. (auth)

8203 (ANCR-1197) EXPERIMENT DATA REPORT FOR SEMISCALE MOD-1 TEST S-01-5 (ISOTHERMAL BLOWDOWN WITH CORE RESISTANCE SIMULATOR). Zender, S. N.; Crapo, H. S.; Jensen, M. F.; Sackett, K. E. (Aerojet Nuclear Co., Idaho Falls, Idaho (USA)). Apr 1975. Contract AT(10-1)1375. 162p. Dep. NTIS $7.60.

Recorded test data are presented for Test S-01-5 of the semiscale Mod-1 isothermal blowdown test series. Test S-01-5 is one of several semiscale Mod-1 experiments which are counterparts of the LOFT nonnuclear experiments. System hardware is representative of LOFT with the design based on volumetric scaling methods and with initial conditions duplicating those identified for LOFT nonnuclear tests. Test S-01-5 was conducted with the secondary side of the steam generator pressurized with nitrogen gas in order to effectively eliminate heat transfer from the steam generator during blowdown and thereby to investigate the effect on overall system behavior of heat transfer from the steam generator. An orificed structure was used in the pressure vessel to simulate the LOFT core simulator. The test was initiated at isothermal conditions of 2270 psig and 540°F by a simulated offset shear of the cold leg broken loop piping. During system depressurization, coolant was injected into the cold leg of the operating loop to simulate emergency core cooling (ECC). Following the blowdown portion of the test, coolant spray was introduced into the pressure suppression tank to determine the response of the pressure suppression system. The uninterpreted data from Test S-01-5 and the reference material needed for future data analysis and test results reporting activities are presented. The data, presented in the form of graphs in engineering units, have been analyzed only to the extent necessary to assure that they are reasonable and consistent. (auth)

8204 (ANL-CT-75-32) ACOUSTIC DETECTION OF SODIUM VOIDS IN THE LMFBR HEAT TRANSFER SIMULATION LOOP. Anderson, T. T.; Bobis, J. P.; Gavin, A. P. (Argonne National Lab., Ill. (USA)). Feb 1975. Contract W-31-109-Eng-38. 38p. AT.

Acoustic sensors located in the upper plenum of the LMFBR Heat Transfer Simulation Loop (HTSL) were used to measure absolute acoustic pressure levels. These sensors, a sodium-immersed microphone, and a waveguide were exposed to 900°F sodium for 400 hours of experiment operation and were unaffected after a year of immersion in sodium. The spectral distribution of the acoustic signals over the frequency range 200 Hz-100 kHz was about 1×10^{-3} bars during sodium boiling, and less than 1×10^{-4} bars during non-cavitating flow. Most of the flow signal occurred in the frequency range below 10 kHz while most of the boiling signal was in the frequency range 10–30 kHz. Maps of bubble position versus time were provided from the HTSL data system. Acoustic impulse signals were observed at times corresponding to: 1) bubble growth, 2) bubble disappearance, and 3) arrival of bubbles at the plenum. (auth)

8205 (BAW-10085(Rev.1)) REACTOR PROTECTION SYSTEM, Revision 1. Fairbrother, D. B.; Vincent, D. R.; Lesniak, L. M. (Babcock and Wilcox Co., Lynchburg, Va. (USA). Nuclear Power Generation Div.). Apr 1975. vp. Babcock and Wilcox, Lynchburg, VA.

The reactor protection system-II (RPS-II) designed for use on Babcock and Wilcox 145- and 205-fuel assembly pressurized water reactors is described. In this system, relays in the trip logic have been replaced by solid state devices. A calculating module for the low DNBR, pump status, and offset trip functions has replaced the overpower trip (based on flow and imbalance), the power/RC pump trip, and the variable low pressure trip. Included is a description of the changes from the present Oconee-type reactor protection system (RPS-I), a functional and hardware description of the calculating module, and a discussion of the qualification program conducted to ensure that the degree of protection provided by RPS-II is not less than that provided by previously licensed systems supplied by B and W. (auth)

8206 (BAW-10092(Rev. 2)) CRAFT2: FORTRAN PROGRAM FOR DIGITAL SIMULATION OF A MULTINODE REACTOR PLANT DURING LOSS OF COOLANT. Revision 2. Hedrick, R. A.; Cudlin, J. J.; Foltz, R. C. (Babcock and Wilcox Co., Lynchburg, Va. (USA). Nuclear Power Generation Div.). Apr 1975. 13p. Babcock and Wilcox, Lynchburg, VA.

Revisions to CRAFT2 (a FORTRAN program written for a CDC-7600 computer) are provided. The program, which is not included, calculates the transient response of a PWR during loss of coolant. (LTN)

8207 (BAW-10106) QUENCH: DIGITAL PROGRAM FOR ANALYSIS OF CORE THERMAL TRANSIENTS DURING LOSS-OF-COOLANT ACCIDENT. Dunn, B. M.; Mody, A. A. (Babcock and Wilcox Co., Lynchburg, Va. (USA). Nuclear Power Generation Div.). May 1975. 21p. Babcock and Wilcox, Lynchburgh, VA.

QUENCH, which was developed as a general calculation program, simulates reactor core thermal transients under loss-of-coolant accident (LOCA) conditions. It includes the effects of heat generation, heat transfer, zirconium-water reaction, cladding melting, and fuel rod slumping. However, some of these options may not be used. For example, core melting, which was important when the code was developed, is not considered at this time. QUENCH is generally used to define variable sensitivity. A general description of the computer program and its mathematical basis as well as a detailed description of the input are provided. (auth)

8208 (CEA-1771) THERMAL HYDRAULIC STUDY ON A LOCAL FLOW BLOCKAGE AROUND A FUEL ELEMENT IN AN ANNULAR CHANNEL. Lafay, J.; Picut, M. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Dept. de Transfert et Conversion d'Energie). May 1974. 78p. (In French). Dep. NTIS (US Sales Only) $7.00.

Local coolant disturbances in fuel elements of liquid metal cooled fast breeder reactor are of great importance to the reactor safety. The heat transfer behind a local flow blockage in a LMFBR fuel assembly determines the cladding and coolant temperature along the flow perturbation. An experimental study is presented using water as the working fluid to determine and measure the hydrodynamic characteristics of the flow in the recirculating region downstream of an impermeable and inert partial blockage with adiabatic conditions and single phase flow and with heat transfer and local boiling. Static pressure fields along two opposite sides of the outer tube are measured for three types of blockages to determine the local pressure drop, the dimension of the wake and to give an interpretation of the evolution of the velocity profile in this region. Some considerations about the transposition of these water results to a sodium flow are exposed. Thermal diffusion calculations with a bidimensional computer code TRIFINAX are made to know the temperature profile inside a real fuel element with each of the three blockages. 14 references. (auth)

8209 (CEA-CONF-2834) PATREC-DE A PROGRAM FOR COMPUTING THE RELIABILITY OF COMPLEX SYSTEMS BY PATTERN RECOGNITION. Blin, A.; Carnino, A.; Jubault, G.; Jegu. (CEA Centre d'Etudes Nucleaires de Saclay, 91 – Gif-sur-Yvette (France). Dept. de Surete Nucleaire). 1974. 22p. (In French). INIS.

From 2nd national congress on reliability; Perros-Guirec, France (17 Sep 1974).

PATREC makes it possible to calculate the reliability of complex systems described in terms of fault trees. In order to save time, the computer scans the tree according to well defined rules and "recognises" certain elementary forms stored in the memory as trees with their mathematical equivalents. The program uses list structures, stacks, and the Polish notations. The problem of dependencies is solved by applying Baye's theorem applied to all inter-dependent elements. The program is written in PL/1; its performance and limitations are explained in detail. The code is very fast and has no limit as to the number of "leaves" and "nodes" in the tree. (FR)

8210 (CEA-N-1771) THERMAL HYDRAULIC STUDY ON A LOCAL FLOW BLOCKING AROUND A FUEL ELEMENT IN AN ANNULAR CHANNEL. Lafay, J.; Picut, M. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Dept. de Transfert et Conversion d'Energie). May 1974. 74p. (In French). INIS.

Local coolant disturbances in fuel elements of liquid metal cooled fast breeder reactors are of great importance to reactor safety. The heat transfer behind a local flow blockage in an LMFBR fuel assembly determines the cladding and coolant temperature along the flow perturbation. An experimental study is presented using water as the working fluid for the determination and the measurement of the hydrodynamics characteristics of the flow in the reticulation region downstream from an impermeable and inert partial blockage, firstly in adiabatic conditions and single phase flow, and secondly with heat transfer and local boiling. Static pressure fields along two opposite generatrices of the outer tube were measured for three types of blockages to determine the local pressure drop, the dimension of the wake, and to give an interpretation of the evolution of the velocity profile in this region. Some considerations about the transposition of these water results to a sodium flow are discussed. Thermal diffusion calculations with a bidimensional computer code, TRIFINAX, were made to determine the temperature profile inside a real fuel element with each of the three blockages. (FR)

8211 (CENPD-98-A) COAST CODE DESCRIPTION. (Combustion Engineering, Inc., Windsor, Conn. (USA)). Apr 1973. 53p. Combustion Engineering, Inc., Windsor, CT.

The loss of coolant flow transient is computed by the COAST digital computer code which calculates the individual loop flow rates and steam generator pressure drops as a function of time following coast-down of any number of reactor coolant pumps. The conservation equations of mass and momentum are solved for the fluid stream in each loop in conjunction with a torque balance on each reactor coolant pump. The analysis utilizes fundamental pump data obtained by the manufacturer. The reactor coolant pumps are full-flow tested to provide the pump head-flow characteristic curve at operating speed. The Affinity Laws are then used to predict pump head-flow-torque characteristics at off design speeds within the first quadrant. Model test data is used to provide these same characteristics in the second quadrant when reverse flow exists in the reactor coolant pumps. Comparisons with experimental data have demonstrated that the mathematical model predicts flows which are conservative in protecting the core from DNB. The model predicts a faster rate of change of flow and a lower flow at the time of reactor trip. These affects combine to provide a lower DNB ratio than would be calculated using experimental data. The attached USAEC Directorate of Licensing review asserts the calculations are satisfactory for partial power outages and in the early stages of a full power outage but are not conservative for later stages of a full power outage. (auth)

8212 (CENPD-139-A) FUEL EVALUATION MODEL. C-E Fuel Evaluation Model Topical Report. (Combustion Engineering, Inc., Windsor, Conn. (USA)). Jul 1974. 300p. Combustion Engineering, Inc., Windsor, CT 06095.

In order to obtain a less restrictive evaluation of the effects of fuel densification than that provided by previous models, Combustion Engineering has developed a more sophisticated fuel evaluation model, including a realistic model for the densification process itself. These new methods will be used by Combustion Engineering in future licensing actions and they are reviewed generically. The essential elements that must be considered in evaluating the effects of densification are as follows: (a) Reductions in pellet diameter cause an increase in the pellet-to-cladding gap size, thus reducing the gap thermal conductance. As a consequence, fuel centerline temperatures and volume-averaged temperatures (stored energy) are increased. (b) Reductions in pellet length cause an increase in the linear heat generation rate of the fuel rods. (c) Reductions in pellet length, combined with some mechanical interaction between the pellets and the cladding, can lead to the formation of axial gaps in the fuel column. The existence of axial gaps produces power spikes (augmentation) in adjacent fuel rods and creates the potential for cladding collapse into the gaps. These elements are included in the Combustion Engineering fuel evaluation model and are discussed. (auth)

8213 (CONF-750413-P1, pp II.1-II.16) MATHEMATICAL ASPECTS OF REACTOR BLOWDOWN. Esposito, V. J. (Westinghouse Electric Corp., Pittsburgh). 1975.

From ANS computational methods in nuclear energy; Charleston, South Carolina, USA (15 Apr 1975).

In proceedings of the conference on computational methods in nuclear engineering. Vol. I. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.; Energy Research and Development Administration, Aiken, S. C. (USA). Savannah River Operations Office).

To simulate a hypothetical loss of coolant accident, a large number of equations describing various thermal-hydraulic phenomena must be solved. A review is presented of some of the existing computational methods used for this simulation. A summary of techniques (multi-dimensional) being considered for more detailed investigation is included. (28 references) (auth)

8214 (CONF-750413-P1, pp II.27-II.52) HYDRODYNAMICS METHODS IN FAST REACTOR SAFETY. Jackson, J. F. Brigham Young Univ., Provo, UT); Weber, D. P. 1975.

From ANS computational methods in nuclear energy; Charleston, South Carolina, USA (15 Apr 1975).

In proceedings of the conference on computational methods in nuclear engineering. Vol. I. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.; Energy Research and Development Administration, Aiken, S. C. (USA). Savannah River Operations Office).

A number of hydrodynamics models have been developed that successfully describe several of the important types of material motion encountered in the analysis of postulated accidents in fast reactors. Most of these models use an explicit numerical solution of the hydrodynamics equations formulated in Lagrangian coordinates, with special techniques included to increase their accuracy and applicability to specific situations. The emphasis to date has been on modeling the physical phenomena, as opposed to the refinement and optimization of the computational procedures. Recently there has been an increased interest in problems that involve describing the motion of molten materials over larger distances and longer time scales. This is producing a trend toward the development of more advanced Eulerian techniques capable of analyzing larger scale displacements and more complicated flow regimes. (45 references) (auth)

8215 (CONF-750413-P1, pp II.53-II.69) ONE-DIMENSIONAL IMPLICIT CHARACTERISTIC METHOD FOR COMPRESSIBLE TWO-PHASE COOLANT FLOW. Nakamura, S.; Berger, M. A.; Spencer, A. C. (Westinghouse Electric Corp., Pittsburgh). 1975.

From ANS computational methods in nuclear energy; Charleston, South Carolina, USA (15 Apr 1975).

In proceedings of the conference on computational methods in nuclear engineering. Vol. I. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.; Energy Research and Development Administration, Aiken, S. C. (USA). Savannah River Operations Office).

The formulation of one-dimensional implicit characteristic equations for arbitrary networks of conduits is presented. The one-dimensional implicit characteristic method for a single homogeneous fluid is extended to include liquid phase, homogeneous two-phase and steam phase so that it can be applied to hypothetical hydraulic transients of the PWR whenever the acoustic effect is not important. Results for typical test problems are illustrated. (8 references) (auth)

8216 (CONF-750413-P1, pp II.85-II.105) IMPLICIT FINITE-DIFFERENCE METHOD FOR FLUID-DYNAMICS CALCULATION IN THE PRIMARY COOLANT SYSTEMS. Wang, C. Y.; Moneim. M. T. A.; Chang, Y. W. (Argonne National Lab., IL). 1975.

From ANS computational methods in nuclear energy, Charleston, South Carolina, USA (15 Apr 1975).

In proceedings of the conference on computational methods in nuclear engineering. Vol. I. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.; Energy Research and Development Administration, Aiken, S. C. (USA). Savannah River Operations Office).

A multidimensional Eulerian finite-difference method for calculating fluid transients in the primary coolant systems of liquid metal fast breeder reactors is described. The full, time-dependent, nonlinear hydrodynamic equations employed in the formulation are approximated by finite-difference forms and solved numerically using the implicit treatment of the density and velocity of the ICE technique. For pressure loading in any range, the method offers a stable and accurate scheme. In the elbow region, a two-dimensional model is considered to approximate the flow in the radial and tangential directions. In the straight pipe or other piping components the flow is assumed to be axisymmetric. The external walls of the pipe and components can be considered either as rigid or deformable, while those of the elbow can only be rigid. In the deformable-wall analysis, a thin-shell model is provided to analyze the dynamic response of the component wall. Three examples are given, illustrating the analysis of pressure-pulse propagation in the fluid contained (1) in an elastic-plastic pipe, (2) in a pipe-elbow loop, and (3) in a simple valve system. (7 references) (auth)

8217 (CONF-750413-P1, pp II.107-II.123) ANALYSIS OF TRANSIENT COMPRESSIBLE TWO-PHASE FLOW WITH HEAT AND MASS SOURCES USING THE METHOD OF CHARACTERISTICS. Willenberg, H. J.; Padilla, A. Jr. (Hanford Engineering Development Lab., Richland, WA). 1975.

From ANS computational methods in nuclear energy; Charleston, South Carolina, USA (15 Apr 1975).

In proceedings of the conference on computational methods in nuclear engineering. Vol. I. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.; Energy Research and Development Administration, Aiken, S. C. (USA). Savannah River Operations Office).

An analytical model has been developed to describe the flow of a two-phase mixture of molten mixed-oxide fuel and fission/fill gases inside a LMFBR fuel pin after cladding failure during a hypothetical unprotected transient overpower excursion. The model incorporates the following features: one-dimensional flow, nonuniform and time-varying cross-sectional area, nonuniform addition of heat and mass, and nonhomogeneous flow by incorporation of a drift flux as a perturbation to the solution for homogeneous flow. The conservation equations were solved by the method of characteristics utilizing the numerical scheme developed by Hartree. A digital computer code entitled HOTPIM (Hydrodynamics of Two-Phase Internal Motion) has been written to solve the characteristic equations. (15 references) (auth)

8218 (CONF-750413-P1, pp II.125-II.144) SLIP FLOW TREATMENT IN THE PLUTO CODE. Wider, H. U.; Jackson, J. F.; Bohl, W. R. (Argonne National Lab., IL). 1975.

From ANS computational methods in nuclear energy; Charleston, South Carolina, USA (15 Apr 1975).

In proceedings of the conference on computational methods in nuclear engineering. Vol. I. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.; Energy Research and Development Administration, Aiken, S. C. (USA). Savannah River Operations Office).

A description of the numerical methods used in the computer model PLUTO is given. This new model calculates the motion of fuel, sodium, and fission-gas during a mild, hypothetical overpower excursion in an LMFBR. Improved methods for the treatment of a transient, homogeneous, compressible fuel froth flow with slowly variable cross section inside a pin and the ejection of this froth through a cladding rupture are described. A new method for treating the transient, one-dimensional, compressible, two-component fuel/sodium-fission-gas slip flow in the coolant channel is discussed. The complete set of seven field equations is solved. Treating the velocity of the light component implicitly and all other unknowns explicitly leads to stable solutions. Lagrangian hydrodynamics are used for both components and it is shown how the necessary rezoning can be done. Also a new artifical viscous pressure formulation for stabilizing the calculation of pressure wave propagation in two-phase media is described. A sample case demonstrates that physically reasonable results can be obtained with the numerics in PLUTO. (8 references) (auth)

8219 (COO-2152-17) INVESTIGATION OF PRESSURE DROPS AND HEAT TRANSFER COEFFICIENTS FOR LOSS OF COOLANT EVALUATIONS. Quarterly Progress Report for Period Ending March 31, 1975. Weisman, J. (Cincinnati Univ., Ohio (USA). Dept. of Chemical and Nuclear Engineering). 1975. Contract AT(11-1)-2152. 13p. Dep. NTIS $4.00.

Progress is reported in the following areas: (1) transient pressure drop investigations, (2) two-phase pressure drop and flow pattern studies, and (3) transition boiling and reflood heat transfer tests. (DG)

8220 (EPRI-NP-2) NUCLEAR POWER DIVISION: RESEARCH PROGRESS REPORT NP-2. (Electric Power Research Inst., Palo Alto, Calif. (USA)). Feb 1975. 31p. NTIS $4.00.

Research progress in areas concerning reactor safety, fuel densification, plutonium recycle, fuel element testing, stress corrosion, etc., is reported. (LTN)

8221 (ERDA tr-27(Vol.1)) EXPERIMENTAL AND THEORETICAL INVESTIGATIONS ON SAFETY OF THE SNR—STRAIGHT-TUBE DESIGN STEAM GENERATOR WITH SODIUM-WATER REACTIONS. Dumm, K.; Sauermann, F.; Schnitker, W.; Welter, A. (Internationale Atomreaktorbau G.m.b.H. (INTERATOM), Bensberg/Koeln (F.R. Germany)). Apr 1972. Translation of INTAT—72.19(Vol.1). 70p. Dep. NTIS $6.50.

A number of large sodium-water reaction tests has been performed in a steam generator model in order to verify the layout criteria of the SNR straight tube design steam generators under accident conditions. The experimental setup is described. The test results and their applicability to the SNR steam generators are given and discussed. (auth)

8222 (ERDA-tr-27(Vol.2)) EXPERIMENTAL AND THEORETICAL INVESTIGATIONS ON SAFETY OF THE SNR—STRAIGHT-TUBE DESIGN STEAM GENERATOR WITH SODIUM-WATER REACTIONS. Dumm, K ; Sauermann, F.; Schnitker, W.; Welter, A. (Internationale Atomreaktorbau G.m.b.H. (INTERATOM), Bensberg/Koeln (F.R. Germany)). Apr 1972. Translation of INTAT—72.19(Vol.2). 113p. Dep. NTIS $8.75.

8223 (GERHTR-90) DETERMINATION OF A GEOMETRY-DEPENDENT PARAMETER AND DEVELOPMENT OF A CALCULATION MODEL FOR DESCRIBING THE FISSION PRODUCTS TRANSPORT FROM SPHERICAL FUEL ELEMENTS OF GRAPHITE MODERATED GAS-COOLED REACTORS. Weissfloch, R. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Reaktorwerkstoffe und Heisse Zellen). Jul 1973. Translation of JUL-985-RW. 43p. Dep. NTIS $4.00.

Thesis.

The fuel elements of High-Temperature Reactors, coated with pyrolitic carbon and covered with graphite, release fission products like all other fuel elements. Because of safety reasons the rate of this release has to be kept low and has also to be predictable. Measured values from irradiation tests and from post-irradiation tests about the actual release of different fission products are present. The physical and chemical mechanism, which determines the release, is extraordinarily complex and in particular not clearly defined. Because of the mentioned reasons a simplified calculation model was developed, which only considers the release-mechanisms phenomenologically. This calculation model coincides very well in its results with values received in experiments until now. It can serve as an interim state on the way to a complete theory. (auth)

8224 (JAERI-M-5808) EVALUATION OF COMPUTER CODE RELAP-3 BY ANALYSES OF BLOWDOWN EXPERIMENTS. Ohnishi, N.; Sobajima, M.; Shimizu, S. (Japan Atomic Energy Research Inst., Tokyo). Sep 1974. 91p. (In Japanese). INIS.

Various simulation experiments on the Loss-of-Coolant Accident in light water cooled reactors have been analyzed by the use of the computer code RELAP-3. The experiments covered are those from the ROSA system of JAERI, Electrotechnical Laboratory of Tokyo, NSR-6 of Japan Shipbuilding Research Association, and Battelle Institute in West Germany. Applying RELAP-3 to these experiments, the sensitivity of the code to the thermal-hydrodynamic parameters such as pressure, leaked mass flow rate, and mixture level during blowdown phenomena was examined. An overall assessment on the predictive capability of the code was performed. The code, developed by Idaho Nuclear Corporation, was made available to JAERI by the courtesy of the corporation. It was subsequently converted for the intended purpose by a working group in the Light Water Safety Analysis Code Committee. (auth)

8225 (JAERI-M-5879) RELATIONS BETWEEN SMALL UNIAXIAL SPECIMEN AND STRUCTURAL MODEL TESTS UNDER CYCLIC LOAD. Fujimura, T.; Miyazono, S. (Japan Atomic Energy Research Inst., Tokyo). Oct 1974. 31p. (In Japanese). INIS.

Increases in size and scale of nuclear power plants give rise to various problems in design and safety of the components such as the reactor pressure vessel and the piping. Design and integrity assessments of the structural components are mostly carried out on the basis of experimental results obtained by tests with small uniaxial specimens. The relations in results between structural model and uniaxial specimen tests, however, are not well established yet. An attempt is made to cast light on this aspect, utilizing experimental data on model and specimen tests in JAERI and elsewhere in the world. (auth)

8226 (JPNRSR-1) PROJECT AND PROGRAM INFORMATION FILE. (Science and Technology Agency, Tokyo (Japan). Atomic Energy Bureau). Oct 1974. 58p. Dep. NTIS (US Sales Only) $6.00.

Reactor safety-related research programs and studies being conducted in Japan are listed. Objectives, current status, results obtained, and future plans are provided for each project. (DG)

8227 (KFK-1274/3, pp vp) SAFETY AND INSTRUMENTATION OF FAST REACTORS. Vaeth, L. Dec 1974. (In German). 8 figs.; 3 tabs.; 5 refs.

In 3rd quarter annual report 1974. (Kernforschungszentrum Karlsruhe (F. R. Germany). Projekt Schneller Brueter).

The theoretical studies of severe accidents have produced some results in the calculation of space-dependent reactor dynamics, material movement during the slumping phase, and the transition between the initial and the disassembly phases. The mechanical effects of a fuel-sodium interaction are studied by way of theoretical calculations and by explosion tests conducted on reactor core models. A concluding report about the development of high capacity sand bed filters for sodium oxide aerosols outlines the results achieved from a capillary model. A comprehensive description is given of contamination measurements carried out in primary cooling circuits of the sodium cooled KNK reactor. (auth)

8228 (KFK-2086) SENSITIVITY STUDIES FOR FAST REACTOR WHOLE CORE ACCIDENTS. Evrard, G.; Froehlich, R.; Renard, A.; Schmuck, P.; Stievenart, M.; Thiem, D. (Kernforschungszentrum Karlsruhe (F. R. Germany)). Mar 1975. 43p. Dep. NTIS (US Sales Only) $5.25.

The energy yield of a hypothetical transient overpower accident of an LMFBR is strongly influenced by core design parameters. The sensitivity of this type of accident on some interesting design parameters is studied for the SNR 300 Mark 1 core. In addition the sensitivity of the energy yield on other parameters of more speculative nature, e.g., the fuel-coolant interaction parameters and the pin failure location, is analyzed. The codes CARMEN 2 and KADIS are used for the analyses of the predisassembly and disassembly phases respectively. Most of the parameter variations are performed consistently for the predisassembly and the disassembly phases. Areas are indicated where further experimental and theoretical work is needed. (auth)

8229 (LIB/Trans-549) BLOWDOWN INVESTIGATIONS WITH REFRIGERANT R12. Belda, W.; Mayinger, F.; Viert, K. P. 1974. Translated by W. Va Peer from German. (CONF-740468-4). 12p. Dep. NTIS (US Sales Only) $4.00.

From reactor conference; Berlin, F. R. Germany (2 Apr 1974).

An investigation was carried out to establish model rules for the initiation of burnout and the heat transfer behavior in the post-

burnout phase during the blowdown using R12 as the liquid model. (AT)

8230 (LIB/Trans-550) SIMULATION OF EVENTS IN THE PROPAGATION OF PRESSURE WAVES BY MEANS OF MULTIPLE-POINT MODELS. Wolfert, K. Dec 1974. Translated by U. Engelbert from German. (CONF-740468-5). 6p. Dep. NTIS (US Sales Only) $4.00.

From reactor conference; Berlin, F. R. Germany (2 Apr 1974).

The simulation of events related to the propagation of pressure waves is examined by the use of multiple point models. The reported work is intended to contribute to the clarification of the question as to how far and to what accuracy the propagation, reflection and superimposition of pressure waves can be simulated by the use of multiple point models. It was found that it is possible to achieve an approximate simulation of pressure wave propagation with multiple point models, if the flow channel is parted off into an adequate number of control volumes. Because of simplifications made when developing the system of conventional differential equations employed in multiple point models, discrepancies occur between calculated and actual values for propagation velocities of pressure irregularities. The size of the discrepancies is proportional to the flow rate. (AT)

8231 (MRR-141) CONCEPT FOR PERTURBATION ANALYSIS, DESCRIBED ON THE EXAMPLE OF THE MALFUNCTION OF THE PRINCIPAL COOLANT PUMP IN A PRESSURIZED WATER REACTOR. Buettner, W. E. (Technische Univ. Muenchen, Garching (F. R. Germany). Lab fuer Reaktorregelung und Anlagensicherung). Oct 1974. 43p. (In German). Dep. NTIS (US Sales Only) $5.25.

The development of a cause-consequence diagram, which can be used for an on-line analysis of system irregularities, is described. The disturbances leading to malfunctions of a main coolant pump of a pressurized water reactor are used as an example. (auth)

8232 (NJD-9) XE-SAFETY ANALYSIS REPORT. (Aerojet-General Corp., Sacramento, Calif. (USA); Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jul 1967. 432p. Dep. NTIS $24.75.

Declassified 11 Sep 1973.

The safety of testing the NERVA Experimental Engine (XE) series in the Engine Test Stand No. 1 (ETS-1) at the Nuclear Rocket Development Station (NRDS) is analyzed. ETS-1 is a new facility which permits testing of the XE series of engines in simulated space conditions. The XE is installed in the nozzle-down attitude in the Engine Test Compartment which is operated at reduced pressure, and exhaust propellant is directed downward into a water-cooled duct that conducts the exhaust away from the test stand and discharges it upward at an angle of approximately 45 degrees from the horizontal. The organizational structure in effect for both test preparation and operation, the training and qualification program for test operation, the procedural controls governing testing and the safety and emergency procedures are described. Significant features of the ETS-1 complex, the E-MAD facility and the Railroad Transport System are listed. The XE test system, including the propellant feed system, the reactor assembly, the thrust chamber, the thrust assembly, the control drum actuator system and the engine control system are described in some detail. The anticipated on-site radiation dose due to direct radiation from the reactor and the estimated on-site and off-site doses from radioactivity entrained in the effluent and carried by the wind are discussed. Experience with NRX/EST and NRX-A5 has indicated that some radioactive particulate material in the size range of 10-200μ is released from the reactor as a result of corrosion. Continued effort is required to determine the true nature of this material and its effect on the general downwind dose rates as well as the dose that may be received by personnel who come in contact with individual particles. Typical operations are described and a safety evaluation of typical operations and tests is included. Emphasis is placed on those equipment features and procedural controls which prevent inadvertent criticality when the system is shut down and which protect the engine during operation. Briefly, the potential sources of accidents can be categorized as control drum runouts, reactor transients due to a rapid increase in hydrogen density in the core and loss of normal or emergency cooling capability. Protection against these eventualities is provided by the nuclear power and period scram systems; monitoring of essential control system voltages and terminating operation if any become abnormal; and monitoring for propellant flow loss and initiating an emergency shutdown using independent coolant systems if propellant flow loss occurs. Protection against hazardous increases in hydrogen density is provided by the procedural controls exercised over the operation of the high pressure LH_2 and gaseous systems which interface with the propellant system. Detailed analyses of postulated accidents are presented along with the limiting conditions for several of the more critical engine components whose failure could potentially lead to overall engine failure. The results establish the minimum safety system characteristics required for protection and serve as a basis for the system evaluation. Based on the results presented and the successful prior testing of comparable reactors at NRDS, it is concluded that testing the X-engine at ETS-1, with the meteorological controls which normally govern the choice of run times, will not result in an undue hazard to the on- or off-site population. (auth)

8233 (NUREG-75/037) SAFETY EVALUATION OF THE LOSS OF FLUID TEST FACILITY PROJECT NO. 394. (Nuclear Regulatory Commission, Washington, D. C. (USA)). May 1975. 112p. NTIS $5.25.

Assessment of the safety of the LOFT facility and subsequent recommendations has been based on a comparison of the LOFT facility to requirements for commercial power reactors. In this comparison, the many unique features of the LOFT facility were considered including the low power level, the limited operational use as a test reactor, and the remoteness of the site. Based on this assessment, it is concluded, that while the likelihood of an accidental release of fission products may be greater than for a commercial power reactor, the consequences of such a release are reduced by the lower fission product inventory, the remoteness of the site and the capability of evacuating the Idaho National Engineering Laboratory (INEL) and adjacent areas. There is reasonable assurance that the public health and safety will not be endangered due to operation of this facility, specifically: The INEL site is acceptable with respect to location, land use, population distribution, controlled access, hydrology, meteorology, geology and seismology. Sufficient engineered safety features have been included to assure that the potential offsite doses are well within 10 CFR Part 100 guidelines. The LOFT facility has been designed in general accordance with standards, guides and codes which are comparable to those applied to commercial power reactors and any exceptions to these have been based on the unique features of the LOFT facility. Certain matters including the final safety analyses based on detailed component designs, Technical Specifications, LOCE controls and detailed program plan have not been reviewed but we assume will properly be resolved by ERDA, which has the ultimate responsibility for the safety of this facility. Changes to the facility design or program plan such as removal of the fueled Mobile Test Assembly or blowdowns to the containment vessel also will require additional analyses and review. (auth)

8234 (ORNL-TM-4805(Vol.3)) QUARTERLY PROGRESS REPORT ON REACTOR SAFETY PROGRAMS SPONSORED BY THE NRC DIVISION OF REACTOR SAFETY RESEARCH FOR OCTOBER-DECEMBER 1974. III. Liquid-Metal-Cooled Fast Breeder Reactor Safety. Fontana, M. H.; Kress, T. S. (Oak Ridge National Lab., Tenn. (USA)). Apr 1975. Contract W-7405-eng-26. 32p. Dep. NTIS $4.00.

Progress in the investigation of the release of fuel, fission products, and transuranic elements from an LMFBR hypothetical core disruptive accident is reported. (DCC)

8235 (RISO-M-1785) RESPONSE TO THE CSNI AD HOC GROUP STANDARD PROBLEM PROGRAM. The USAEC Standard Problem One For Blowdown. Andersen, P. S. (Danish Atomic Energy Commission, Risoe. Research Establishment). Mar 1975. 26p. Dep. NTIS (US Sales Only) $4.50.

The USAEC Standard Problem One for blowdown (the Edwards and O'Brien single pipe blowdown) was considered. The calculations were performed on a Burroughs B6700 by the program TPD3, which features individual mass conservation equations for the phases and the consideration of thermal non-equilibrium for the water. The USAEC prescribed "adjusted" initial temperature distribution led to an underprediction of the pressure after the expansion wave. A second calculation was therefore performed using the initial temperature measured and reported by Edwards and O'Brien. This result showed good agreement with the measured pressure response. (auth)

8236 (RISO-M-1974) ASSUMPTIONS UNDERLYING RELIABILITY PREDICTION. Taylor, J. R. (Danish Atomic Energy Commission, Risoe. Research Establishment). Apr 1975. 12p. Dep. NTIS (US Sales Only) $4.00.

The whole process of reliability prediction for process plant rests on certain assumptions about the way components and process plant behave. It is important to check if these assumptions hold in practice. In some cases they do not, and here the normal procedures of failure mode analysis and fault tree analysis must be modified and supplemented. Some of the more important assumptions are discussed. (auth)

8237 (STI/PUB-378) ENVIRONMENTAL EFFECTS OF COOLING SYSTEMS AT NUCLEAR POWER PLANTS. Pro-

ceedings Series. Proceedings of a symposium held at Oslo, Norway, August 26–30, 1974. (International Atomic Energy Agency, Vienna (Austria)). Feb 1975. 841p. (In several languages). (CONF-740820-). IAEA $47.00.

A total of forty-nine papers dealing with power plant thermal effluents and their environmental effects is presented. Each paper was separately abstracted and indexed for NSA. (DG)

For abstracts of individual papers see: 8052, 8253–8297, 8356, 8357, and 8411.

8238 (TID-3525-R5-S9) REACTOR SAFETY. A Literature Search. Rushing, J. W. (Comp.). (Energy Research and Development Administration, Oak Ridge, Tenn. (USA). Technical Information Center). May 1975. 100p. Dep. NTIS $5.45.

Included are 677 citations to report literature abstracted in Nuclear Science Abstracts during the period July 1973 through December 1974 on safety aspects of nuclear reactor design, siting, materials, engineered safeguards, and operating procedures. The reports cited concern the reliability of reactor systems and components, the consequences of potential accident conditions, and safety in power plant operations. Subject, author, and report number-availability indexes are included. (auth)

8239 (WANL-TME-1633) NRX-A6 SAFETY EVALUATION REPORT. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Oct 1967. 225p. Dep. NTIS $14.25.

Declassified 12 Sep 1973.

The NRX-A6 test series will be conducted in the Test Cell "C" facilities at NRDS. The primary objective is to operate at rated conditions for a period of up to 60 minutes or until a limiting loss of reactivity thru fuel corrosion has occurred. The test specification contains further detail on the planned testing. The NRX-A6 test series includes low power checkout of the test article, to verify that it and the facility systems are ready for power testing and for calibration of the control drum and neutronic systems. Both an ambient gaseous nitrogen and a liquid nitrogen flow test will be conducted during the low power checkout phase. The former will verify the operational readiness of the instrumentation and demonstrate the structural integrity of the newly designed reflector and lateral support system; while the latter will provide a low temperature stimulus for the temperature transducers. For operation at rated conditions, propellant flow will be controlled thru a programmed demand of flow and reactor power will be controlled thru a temperature loop closed on nozzle chamber temperature. A joint testing organization composed of both LASL and NTO personnel has been established to carry out the facility preparation, checkout testing and conduct of the reactor test. NERVA management, by an agreement of understanding with LASL, has line authority thru NTO for the effort at Test Cell "C" facilities as they pertain to the NRX-A6 test program. The NRX-A6 reactor has the same general configuration as the reactors previously tested (NRX-A2 thru A5) although several design changes have been made. The more significant changes are the elimination of the graphite inner reflector cylinder, use of a reflector composed of three beryllium rings, modification of the core periphery and core lateral support system, and support of the reactor on the pressure vessel (aft end) and nozzle. Test Cell "C" facilities, the reactor control system, the propellant flow control system and facility control are described briefly. Particularly significant, in comparison with Test Cell "A" facilities, is a LH_2 storage capacity of approximately 1,000,000 gallons which is more than sufficient for 60 minutes operation at rated flow, and a turbine energy source which vaporizes LH_2 for use as the turbopump drive gas and for Dewar pressurization. During operation the reactor will be enclosed by a 360° radiation shield which significantly decreases the heat deposition in the facilities and the neutron activation of the test cell. A High Pressure Dewar system operating at about 300 psi provides coolant in the event of an emergency shutdown. This system "floats" on line and initiates flow without control action as propellant flow thru the turbopump decays on emergency shutdown. A safety evaluation of certain planned test operations and the results of analyses of postulated malfunctions are presented. The protection afforded by the safety systems following malfunctions leading to control drum runout, LH_2 insertions and loss of coolant have been investigated. (auth)

8240 (WANL-TME-1662) PRELIMINARY EXAMINATION OF AN AUXILIARY THRUST SAFETY COUNTERMEASURE WITH RESPECT TO POST-OPERATIONAL INTEGRITY OF THE NERVA REACTOR. Brown, W. S. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1967. 84p. Dep. NTIS $7.25.

Declassified 12 Sep 1973.

An auxiliary thrust system (ATS) has been proposed as a safety countermeasure to minimize or eliminate potential radiological safety problems in the event of an in-flight abort of a NERVA type rocket engine. If a flight failure occurs, auxiliary rocket motors attached to the nuclear stage would provide controlled disposal of the radioactive nuclear engine by insuring either a deep ocean impact of the radioactive material, or by boosting the stage/engine assembly into a long-lived Earth orbit. Earlier studies have shown the ATS concept is feasible using solid propellants and can provide safe disposal in the event of an in-flight accident resulting in immediate loss-of-coolant to the NERVA reactor. However the requirements or restrictions that a successful ATS operation places on a failed NERVA reactor following a loss-of-coolant accident have not been investigated. The effect of ATS operations on the structural integrity of the reactor system was examined, and the constraints that successful use of the ATS countermeasure may impose upon the NERVA reactor/engine design were defined. (auth)

8241 (WANL-TNR-117) HYDRODYNAMICS OF NERVA CORE IMMERSION. Bodenschatz, C. A. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). [nd]. 105p. Dep. NTIS $8.25.

Declassified 10 Sep 1973.

Since the NERVA core is undermoderated, it is very sensitive to insertions of hydrogenous fluids. One of the potential excursions of concern in the Safeguards Engineering Program results from the immersion of a NERVA core in water. Even though redundant countermeasures will be provided, the releases of energy and fission products during such an excursion are sufficient to warrant further investigation. This is particularly true if the excursion were to occur near a populated area, or in shallow water. Two general types of flooding during the immersion of a NERVA core in water have been suggested: A gradual flooding of normal density water into the core due to the static pressure head and a hydrodynamic impact flooding, i.e., a fast transient flow of water with reduced mean density into the core caused by the shock pressures from water impact. The basic objective of this study was to predict the initial rise rate and density of water for each of these types of flooding. Also, several nozzle-core configurations and the subsequent flow restriction have been considered. (auth)

8242 (WASH-1535(Vol.1)) LIQUID METAL FAST BREEDER REACTOR PROGRAM. Volume I. Environmental Statement. (USAEC, Washington, D.C.). Dec 1974. 149p. Dep. NTIS $10.50.

A summary of the entire Environmental Statement and background information on the U. S. energy economy, the LMFBR Program and the relationship between the two are presented. The past, current and projected uses of energy and its importance to society, and the role of electricity, including that produced by nuclear reactors, in helping to meet the Nation's energy requirements are discussed. The origins and history of the LMFBR Program and a brief discussion of the several experimental and special purpose fast reactors that have been built in the United States since the late 1940's are included. The fast reactor programs in other industrialized nations are reviewed. A discussion of the current U. S. LMFBR program is offered which highlights the important program planning mechanisms, the key reactor plants now under design and construction, and the various supporting studies on LMFBR costs, technology, environmental impacts, and program planning. (auth)

8243 (WASH-1535(Vol.2)) LIQUID METAL FAST BREEDER REACTOR PROGRAM. Volume II. Environmental Statement. (USAEC, Washington, D. C.). Dec 1974. 945p. Dep. NTIS $50.25.

The direct environmental impact of each element of the LMFBR fuel cycle is described. The power reactors, fuel fabrication plants and fuel reprocessing plants that make up the LMFBR fuel cycle are examined. The siting considerations, plant characteristics, effects on the environment from construction and normal operation, and environmental monitoring programs that together entail a complete environmental evaluation are discussed. An evaluation of the potential environmental impacts of various types of accidents in the facilities comprising the LMFBR fuel cycle is included. The transportation of radioactive materials between these facilities, the management of radioactive wastes produced in LMFBR activities, and the properties of plutonium and its behavior in the environment and the resulting health effects are analyzed. Extensive supporting data are provided in the appendices. An examination of the related sociopolitical impacts of the LMFBR is presented. (auth)

8244 (WASH-1535(Vol.3)) LIQUID METAL FAST BREEDER REACTOR PROGRAM. Volume III. Environmental Statement. (USAEC, Washington, D. C.). Dec 1974. 623p. Dep. NTIS $34.25.

The various alternative technologies, nuclear as well as nonnuclear, that might be utilized in conjunction with or instead of

the LMFBR to satisfy the Nation's future electric power requirements are examined. The options considered include the further implementation of various types of nuclear power reactors such as the already existing light water reactor and high temperature gas-cooled reactor, as well as the development of alternative breeder reactors such as the gas-cooled fast reactor, light water breeder reactor and molten salt breeder reactor. The development of another potential nuclear energy system, controlled thermonuclear fusion, is also addressed. The possibilities of increased emphasis on the use of conventional fossil fuels, namely coal, oil and natural gas, and the development of unconventional fossil fuels such as oil shale and domestic tar sands are discussed, followed by consideration of the further development of additional nonnuclear energy sources such as hydroelectric power systems, geothermal energy, solar energy, and other potential sources of power. Each option is examined as to the extent of its energy resource base, the research and development program that would be required (if any) to bring the option into commercial use, the environmental implications of its utilization and the costs and benefits associated with its use, in order to assess its capability for satisfying projected energy requirements. The use of improved energy conversion and storage devices such as gas turbines, fuel cells and magnetohydrodynamics is discussed. An examination of the various elements of a potential national effort in energy conservation to assess their capabilities for reducing projected energy demands and thereby replacing partially or entirely the need for additional power sources such as the LMFBR is presented. (auth)

8245 (WASH-1535(Vol.4)) LIQUID METAL FAST BREEDER REACTOR PROGRAM. Volume IV. Environmental Statement. (USAEC, Washington, D. C.). Dec 1974. 556p. Dep. NTIS $31.00.

A broad overview is presented of the many implications of LMFBR program implementation, up to and encompassing a fully developed LMFBR power plant economy, including the secondary impacts, the unavoidable adverse environmental impacts, cumulative environmental impacts, and cost-benefit analyses, and alternative energy strategies. Under the heading of secondary impacts, the national implications of the availability of electricity from LMFBRs, and the specific economic impacts of the LMFBR program are examined. The currently feasible alternatives and potential future alternatives for mitigating adverse environmental impacts of the LMFBR fuel cycle are described. The problems of safeguarding special nuclear material from potential diversion to unauthorized purposes are analyzed. The cumulative environmental effects of LMFBR operation to the Year 2020, the decommissioning of LMFBRs and fuel cycle facilities upon the completion of their useful life, the irreversible and irretrievable commitments of resources that will accompany implementation of an LMFBR economy, and an analysis of the costs and benefits of implementing the LMFBR Program are included. (auth)

8246 (WASH-1535(Vol.5)) LIQUID METAL FAST BREEDER REACTOR PROGRAM. Volume V. Environmental Statement. (USAEC, Washington, D. C.). Dec 1974. 641p. Dep. NTIS $35.25.

Comment letters number 1 through 25 on the LMFBR Program Draft Environmental Statement and the AEC's response are presented. These comment letters were systematically and comprehensively analyzed in the preparation of the Final Environmental Statement to identify and categorize the points raised. This analysis served to identify ten major topics of concern. Further examination of each topic identified about a dozen major issues, which reappeared throughout most of the letters. The procedure followed in addressing the issues in the Final Statement has been to state the problem, express the AEC view, cite responsible opposing and/or supporting views, and arrive at a conclusion with the bases for that conclusion supported by the best available information. When views other than those of the AEC are cited, the name of the commenter or organization espousing those views is identified. (auth)

8247 (WASH-1535(Vol.6)) LIQUID METAL FAST BREEDER REACTOR PROGRAM. Volume VI. Environmental Statement. (USAEC, Washington, D. C.). Dec 1974. 653p. Dep. NTIS $35.75.

Comment letters number 26 through 36 on the LMFBR Program Draft Environmental Statement and the AEC's responses are presented. These comment letters were systematically and comprehensively analyzed in the preparation of the Final Environmental Statement to identify and categorize the points raised. This analysis served to identify ten major topics of concern. Further examination of each topic identified about a dozen major issues, which reappeared throughout most of the letters. The procedure followed in addressing the issues in the Final Statement has been to state the problem, express the AEC view, cite responsible opposing and/or supporting views, and arrive at a conclusion with the bases for that conclusion supported by the best available information. When views other than those of the AEC are cited, the name of the commenter or organization espousing those views is identified. (auth)

8248 (WASH-1535(Vol.7)) LIQUID METAL FAST BREEDER REACTOR PROGRAM. Volume VII. Environmental Statement. (USAEC, Washington, D. C.). Dec 1974. 619p. Dep. NTIS $34.00.

Comment letters number 39 through 66 on the LMFBR Program Draft Environmental Statement and the AEC's responses are presented. These comment letters were systematically and comprehensively analyzed in the preparation of the Final Environmental Statement to identify and categorize the points raised. This analysis served to identify ten major topics of concern. Further examination of each topic identified about a dozen major issues, which reappeared throughout most of the letters. The procedure followed in addressing the issues in the Final Statement has been to state the problem, express the AEC view, cite responsible opposing and/or supporting views, and arrive at a conclusion with the bases for that conclusion supported by the best available information. When views other than those of the AEC are cited, the name of the commenter or organization espousing those views is identified. (auth)

8249 (XN-74-21(Rev.2)) XTHETA: MULTI-MODE HEATUP CODE FOR SINGLE CHANNEL TRANSIENT ANALYSIS. Lang, F. D.; Steves, L. H.; Worley, L. C.; Bjornard, T. A. (Exxon Nuclear Co., Richland, Wash. (USA)). 7 Apr 1975. 367p. Exxon Nuclear Co. Inc., Richland, WA.

A multi-mode heatup code for calculating the thermal response of fuel rods during a LOCA in a light water reactor is described. A benchmark calculation is presented and the code is compared with other codes. (JWR)

8250 (XN-75-1) COMPUTATIONAL SIMULATIONS OF PRESSURIZED WATER REACTOR FULL LENGTH EMERGENCY COOLING HEAT TRANSFER EXPERIMENTS. Lang, F. D. (Exxon Nuclear Co., Richland, Wash. (USA)). 28 Mar 1975. 106p. Exxon Nuclear Co. Inc., Richland, WA.

Simulations of numerous Full-Length Emergency Cooling Heat Transfer (FLECHT) experiments using XTHETA/MOD002 has provided an important benchmark in establishing this code as a viable computational tool for PWR loss-of-coolant accident analysis. All simulations produced maximum clad temperature within error bands established for experimental repeatability and the data scatter of individual thermocouples. The data base contained in sensitivity studies of FLECHT experiments, clad temperature profiles, axial temperature profiles, and quench times will allow interpolation of simulation results to actual plant conditions postulated for LOCA. Results for XTHETA are plotted against FLECHT measurements. It is observed that there is no general bias in the results. Detailed results are presented. Appendix A contains FLECHT data sheets describing in further detail the experiments used, as well as comparison plots of clad temperature at rod midplane and heat transfer coefficients, both as functions of time. Appendix B contains axial temperature profiles from XTHETA compared to FLECHT experiments. 17 references. (auth)

8251 (XN-75-5) SLIX: AN INTERFACE AND DATA SMOOTHING ROUTINE BETWEEN RELAP4 AND XTHETA. Lang, F. D. (Exxon Nuclear Co., Richland, Wash. (USA)). 28 Mar 1975. 26p. Exxon Nuclear Co. Inc., Richland, WA.

Safety analysis of light water reactors requires definition of transient hydraulic conditions encountered during rapid depressurization. RELAX, or other versions of the RELAP4 code, can be used to describe this transient. Outputs from RELAP4 are then used as boundary conditions for single rod heatup analysis performed by codes such as XTHETA. One of the requirements of 10CFR50, Appendix K is that: "The calculated flow shall be smoothed to eliminate any calculated rapid oscillations (period less than 0.1 second)." The SLIX code described in this manual is a data smoothing interface between the RELAP4 codes and XTHETA. SLIX retrieves the user-requested RELAP4 edit variables from a RELAP4 tape in the edit time steps, smooths the data using one of several averaging schemes, chooses the required smoothed values, and punches them on cards in the XTHETA format. The code will also operate using any edit tape based on the RELAP4 output tape format. SLIX is presently operational on either the CDC 6600 or the IBM 360 computers. (auth)

8252 (XN-75-19) CARRYOUT RATE FRACTION CORRELATION FOR PRESSURIZED WATER REACTORS. Lang, F. D. (Exxon Nuclear Co., Richland, Wash. (USA)). 24 Mar 1975. 16p. Exxon Nuclear Co. Inc., Richland, WA.

Safety analysis of pressurized water reactor segregates accidents involving loss of coolant generally into three time frames:

blowdown, heatup and reflood. For evaluation of the effects of the reflood transient, knowledge of the reactor's outlet flow rate and the level of the quench front along the rod length is vitally important. To obtain a measure of this flow rate a correlation of the carryout rate fraction (CRF) has been developed from experimental data. The correlation was specifically developed for low flooding rates currently being encountered in loss of coolant accident analyses. Until this time no correlation has been available which reasonably predicts carryout rate fraction for flooding rates less than 2.0 in./sec. (auth)

8253 MANAGEMENT OF WASTE HEAT AT NUCLEAR POWER STATIONS, ITS POSSIBLE IMPACT ON THE ENVIRONMENT, AND POSSIBILITIES OF ITS ECONOMIC USE. Belter, W. G. (Atomic Energy Commission, Washington, DC). pp 3-23 of Environment Effects of Cooling Systems at Nuclear Power Plants. Vienna; International Atomic Energy Agency (Feb 1975).

From symposium on the physical and biological effects on the environment of cooling systems and thermal discharges at nuclear power stations; Oslo, Norway (26 Aug 1974). See STI/PUB-378; CONF-740820-.

An increasing concern in the United States of America over the effects of rising temperatures in surface waters and the limited long-term availability of adequate cooling-water supplies has resulted in a trend towards the use of closed-cycle cooling systems for control of thermal discharges from large steam-electric power plants. The development of dry-cooling tower systems is proceeding for future use in water-short areas of the USA, where evaporative losses of water from wet-cooling towers are becoming unacceptable. Both Federal and industrial research is continuing to increase on the ecological effects of heated-water discharges, with greater emphasis now being placed on large-scale field studies in the vicinity of both fossil-fuel and nuclear power plants. Adoption by the United States Environmental Protection Agency of effluent guidelines for steam-electric power plants requiring "essentially no discharge" of thermal pollutants can have a significant bearing on the direction and extent of future thermal effects research. Beneficial uses of waste heat from steam-electric power plants will have no significant effect on either the thermal pollution or plant-siting problems for large-scale nuclear power plants. A continuing energy shortage during the next decade may provide the stimulus for a greater use of heat on a broader scale during this period. (auth)

8254 ENVIRONMENTAL ASPECTS OF THE COOLING SYSTEMS OF THERMAL POWER STATIONS: REPORT ON THE SEMINAR HELD AT ZURICH, FROM 14 TO 16 MAY 1974; CONCLUSIONS AND RECOMMENDATIONS. Lopez-Polo, C. (Commission Economique des Nations Unies pour l'Europe, Geneva). pp 25-34 of Environmental Effects of Cooling Systems at Nuclear Power Plants. Vienna; International Atomic Energy Agency (Feb 1975). (In German).

From symposium on the physical and biological effects on the environment of cooling systems and thermal discharges at nuclear power stations; Oslo, Norway (26 Aug 1974). See STI/PUB-378; CONF-740820-.

The following topics are examined: (a) the overall thermal balance of the atmosphere and residual heat from electricity generation; (b) air-cooling systems and their consequences for the environment; and (c) the comparative economics of different cooling systems. (auth)

8255 TWO-DIMENSIONAL HYDRODYNAMIC MODEL FOR COOLING-TOWER PLUMES. Trepp, J. P. (Swiss Federal Inst. for Reactor Research (EIR), Wuerenlingen, Switzerland). pp 37-44 of Environmental Effects of Cooling Systems at Nuclear Power Plants. Vienna; International Atomic Energy Agency (Feb 1975).

From symposium on the physical and biological effects on the environment of cooling systems and thermal discharges at nuclear power stations; Oslo, Norway (26 Aug 1974). See STI/PUB-378; CONF-740820-.

Large power plants with cooling towers, whether of the wet or dry type, have certain effects on the micro climate owing to the waste heat which is transferred to the atmosphere. The plume physics simulation is described, and it is hoped that better predictions of the influences on the micro climate can be made. The cooling-tower plume is simulated in a two-dimensional computer model, which solves numerically the time-dependent equations of motion, continuity, and those that describe the transport of heat, water vapor, and water droplets for the lower atmosphere. The cloud physics work of Takeda and Orville and the early turbulence studies by Boussinesq and Prandtl are used to describe the turbulent flow hydrodynamic model. The turbulent transfer is represented either by a constant eddy viscosity or by the Prandtl mixing-length hypothesis. Condensation, evaporation, coagulation, breaking, and the terminal fall velocity of water droplets relative to air are included. The size distribution of the water droplets is given as a discrete spectrum of five droplet sizes. The model calculates for each time step the temperature, relative humidity, and cloud and rainwater content for each grid point, and also the wind field. The model requires experimental verification. To this end, measurements on existing dry- and wet-cooling towers have already been started for a three-dimensional field of the above parameters. (auth)

8256 FOG FORMATION AND FOG ELIMINATION. Berliner, P. (Gesellschaft fuer Kernforschung mbH, Karlsruhe, Ger.). pp 75-84 of Environmental Effects of Cooling Systems at Nuclear Power Plants. Vienna; International Atomic Energy Agency (Feb 1975).

From symposium on the physical and biological effects on the environment of cooling systems and thermal discharges at nuclear power stations; Oslo, Norway (26 Aug 1974). See STI/PUB-378; CONF-740820-.

Six thermodynamic process phases have to be passed before fog and its secondary effects disappear in the environment of evaporative cooling towers: I. enthalpy rise of the air within the nonsaturation range; II. fog formation in the air leaving the saturation state; III. elevation of the warmed air to the top of the chimney; IV. mixing of the warmed air with the ambient air within the two-phase range of supersaturation; V. condensation of warmed air on the ground; and VI. enthalpy decrease of the air within the nonsaturation range. The six process phases are demonstrated on psychrometric charts. Together with an analytical presentation of fog formation and natural fog elimination in common evaporative cooling towers, the six possible operation processes to prevent fog are explained with the aid of psychrometric charts. Three elementary and three combinative operation processes are to be considered. To evaluate the economies of these technical solutions numerical conclusions have been reached. The extensive variety of possible processes can be reduced by setting a limit: an equilibrium state of the warmed air leaving the cooling tower indicates this limit. No droplet of fog should remain, and no further step to enter the nonsaturation range should occur. Consequently, only equilibrium two-phase processes that terminate just at the saturation line need to be treated. This economic theorem facilitates the thermodynamic analysis and allows numerical results to be obtained. The six possible operation concepts can be summarized as: (i) increase of heat transfer surface to reduce the cooling-water temperature; (ii) increase of air rate to reduce the enthalpy rise beyond the saturation line; (iii) application of dry convective cooling in closed cycles; (iv) mixing of supersaturated moist air with separately warmed dry air; (v) evaporation and subsequent dry operation; and (vi) dry operation and subsequent evaporation. The numerical thermodynamic conclusion demonstrates that a small amount of warm dry air is sufficient to prevent any fog in the vicinity of common cooling towers. (auth)

8257 COOLING-TOWER EXPERIENCE AND THE METEOROLOGICAL CONSEQUENCES OF THERMAL DISCHARGES FROM NUCLEAR POWER PLANTS IN THE FEDERAL REPUBLIC OF GERMANY. Bartels, H.; Caspar, J. W. (Deutscher Wetterdienst, Offenbach/M., Ger.). pp 85-98 of Environmental Effects of Cooling Systems at Nuclear Power Plants. Vienna; International Atomic Energy Agency (Feb 1975).

From symposium on the physical and biological effects on the environment of cooling systems and thermal discharges at nuclear power stations; Oslo, Norway (26 Aug 1974). See STI/PUB-378; CONF-740820-.

A summary is given of studies made of the form and extent of thermal discharges in relation to atmospheric conditions. The prevailing local meteorological conditions are of great importance for siting nuclear power plants. Apart from the dissipation of radioactive substances, above all they influence the local climate by heat released by the cooling systems. Therefore, sites are investigated in the Federal Republic of Germany before a power plant is planned and constructed. The measuring techniques are described and some examples are given of the results obtained by means of numerical models of the meteorological effects, in particular the extent of the changes of air temperature, air humidity, shadows due to clouds, and precipitation depending on the site and type of cooling tower. (auth)

8258 TRAPPING OF HEAT IN SILL FJORDS. Carstens, T. (Norwegian Inst. of Tech., Trondheim, Norway). pp 99-112 of Environmental Effects of Cooling Systems at Nuclear Power Plants. Vienna; International Atomic Energy Agency (Feb 1975).

From symposium on the physical and biological effects on the environment of cooling systems and thermal discharges at nuclear power stations; Oslo, Norway (26 Aug 1974). See STI/PUB-378; CONF-740820-.

A survey is presented of the peculiar dynamics of sill fjords, which are fjords, generally of glacial origin, with transverse

bottom ridges. The presentation is non-mathematical and qualitative. The combined effects of topography and layering create bodies of water that are to a large extent sheltered from the normal movements of inshore waters. The deep basins behind sills are therefore characterized by long residence times compared with flat-bottomed inlets. Annual renewal of the deep water occurs in most basins, and there are different mechanisms responsible for summer and winter exchange. The deep water exchange cycle is asymmetric and consists of a rapid gravitational inflow followed by a slower diffusive outflow. The gravitational exchange is usually governed by salinity differences so large that the water temperature is of little or no importance for the process. Waste heat present in the vicinity of a shallow sill may end up at the bottom of a deep basin, unless it is mixed into the brackish surface layer. (auth)

8259 COMPUTATIONS OF THE TEMPERATURE RESPONSE OF STRATIFIED SILL FJORDS TO COOLING-WATER DISCHARGES. Audunson, T.; Land, J.; Rye, H. (Tech. Univ., Trondheim, Norway). pp 113-140 of Environmental Effects of Cooling Systems at Nuclear Power Plants. Vienna; International Atomic Energy Agency (Feb 1975).

From symposium on the physical and biological effects on the environment of cooling systems and thermal discharges at nuclear power stations; Oslo, Norway (26 Aug 1974). See STI/PUB-378; CONF-740820-.

Numerical calculations of thermal effects of power plant thermal discharges on seasonal temperature cycles in two stratified sill fjords in the Oslofjord area are described. The analysis is based on a one-dimensional transient approach which takes into account spatial and temporal variations in the vertical eddy diffusion coefficient and in the horizontal in- and out-flows to the fjords. Temperature effects, salinity effects, and wind shear effects on the vertical diffusion coefficient are considered through an assumed functional relationship between the vertical eddy-diffusion coefficient and the stability of the water column. Corroboration of the calculations by actual observations is used as a necessary criterion for the physical realism of the model and its boundary conditions. Waste heat from a nuclear power station using a once-through cooling system is then introduced into the calculations and excess temperatures are calculated. The mean discharge-induced temperature increase is then judged against the natural level of temperature fluctuations at various depths. The calculations also demonstrate the strong dependency of excess temperatures upon the exchange conditions across the sills. (auth)

8260 HEAT DISCHARGES INTO THE SEA AT THE OLKILUOTO SITE: LABORATORY MODEL TEST RESULTS AND REASONS FOR SELECTED ARRANGEMENTS. Mikkola, I. (Teollisuuden Voima OY/Industrins Kraft Ab (TVO), Kilo, Finland). pp 141-150 of Environmental Effects of Cooling Systems at Nuclear Power Plants. Vienna; International Atomic Energy Agency (Feb 1975).

From symposium on the physical and biological effects on the environment of cooling systems and thermal discharges at nuclear power stations; Oslo, Norway (26 Aug 1974). See STI/PUB-378; CONF-740820-.

A description is given of the physical behavior of thermal discharges from a coastal multiple power reactor site as observed in hydraulic laboratory model tests, where 20 km × 11.5 km of sea was built to a scale of 1 : 500. The design of cooling arrangements is discussed, interpreting some results with the aid of the jet stream theory and Swedish control observations. (auth)

8261 HEATING OF ESTUARINE AND COASTAL WATERS BY NUCLEAR POWER STATIONS IN FRANCE. Daubert, A. (Electricite de France, Chatou). pp 151-162 of Environmental Effects of Cooling Systems at Nuclear Power Plants. Vienna; International Atomic Energy Agency (Feb 1975). (In French).

From symposium on the physical and biological effects on the environment of cooling systems and thermal discharges at nuclear power stations; Oslo, Norway (26 Aug 1974). See STI/PUB-378; CONF-740820-.

A description is given of studies of the induced heating of waters at several sites under consideration for the construction of nuclear power stations. The principal factors which govern the size and intensity of the thermal plume, and which should be considered in formulating the problem, are analyzed—namely, the convection parameters (average convection and dispersion) and atmospheric exchange. The former cause the heated waters to spread over a certain surface area and the latter produces heat transfer through the surface. Depending on the circumstances, the velocity field was obtained by means of mathematical models, on the basis of experimental studies with a physical model, or directly by in-situ measurements. On the other hand, the temperature field was calculated in all cases by means of mathematical models because of the importance of the phenomenon and the need to take into account atmospheric exchange. Examples of results are given for an estuarine site, a site on a straight coastline and a site sheltered by a harbor. (auth)

8262 COMPARISON OF AERIAL INFRA-RED AND IN-SITU THERMAL PLUME MEASUREMENT TECHNIQUES. Madding, R. P. (Univ. of Wisconsin, Madison); Tokar, J. V.; Marmer, G. J. pp 163-186 of Environmental Effects of Cooling Systems at Nuclear Power Plants. Vienna; International Atomic Energy Agency (Feb 1975).

From symposium on the physical and biological effects on the environment of cooling systems and thermal discharges at nuclear power stations; Oslo, Norway (26 Aug 1974). See STI/PUB-378; CONF-740820-.

In-situ and remote-sensing techniques for measuring thermal plumes are compared for five separate occasions. The remote-sensing aspect of the experiment was done by The University of Wisconsin using a DC-3 as a platform. Thermal scans were made with a Texas Instrument RS-18A scanner in the 8- to 14-μm range. The data were recorded on analog tape and later digitized. The in-situ method was used by Argonne National Laboratory, employing a 5.5-m cathedral-hull fiberglass boat. Temperatures at the surface and at various depths were measured with fast-response thermistor probes. The boat position was determined with a Motorola Mini-Ranger range-positioning system. Comparison of the plumes from both methods indicates good agreement with respect to the general plume configuration, areas within isotherms, and centerline temperature decays. The only exception to this conclusion is found on one day, 6 June 1973, an exceptionally calm day with no waves and extremely low wind and ambient water velocities. Probable reasons for disagreement under such ambient conditions are discussed. The inherent advantages and disadvantages of each method are discussed in light of the results of the two sets of data. This includes both the data collecting and data analyzing procedures. It is concluded that judicious combination of both methods offers a better picture of thermal plumes than can be obtained by either technique alone. (auth)

8263 CHALK POINT COOLING TOWER PROJECT. Pell, J. (Dept. of Natural Resources, Annapolis, MD). pp 187-216 of Environmental Effects of Cooling Systems at Nuclear Power Plants. Vienna; International Atomic Energy Agency (Feb 1975).

From symposium on the physical and biological effects on the environment of cooling systems and thermal discharges at nuclear power stations; Oslo, Norway (26 Aug 1974). See STI/PUB-378; CONF-740820-.

Although a few small brackish water hyperbolic cooling towers do exist, the first large such installation will commence operation in November 1974 in the USA at Chalk Point Generating Station Unit 3 of the Potomac Electric Power Company about 60 km southeast of Washington, D. C. The Marley tower is specified as meeting a maximum drift rate (carryover) of 2×10^{-3}% of the circulating water flow-rate at design conditions (<20 liter/min). The overall objectives of the Chalk Point Cooling Tower Project are to characterize fully the effluent plume discharged to the atmosphere in order to enable scientists to assess environmental impacts of such hyperbolic cooling towers, both with regard to phenomena such as fogging, precipitation enhancement, and downwind icing, and to possible effects on vegetation and man-made structures by the deposition of salts originating in brackish or saline water drift. The Project brings together for the first time intensive monitoring within (and at the point of discharge of) a large non-freshwater hyperbolic cooling tower with the intent of fully characterizing the effluent plume, together with ground observations by stereo photography, comprehensive on-site meteorology, a major vegetation-effects and mathematical modeling program, and airborne instrumentation. (auth)

8264 SEASONAL FEATURES OF THERMAL ABATEMENT OF SHORELINE DISCHARGES AT NUCLEAR SITES. Kamath, P. R.; Bhat, I. S.; Gurg, R. P.; Adiga, B. B.; Chandramouli, S. (Bhabha Atomic Research Centre, Bombay). pp 217-225 of Environmental Effects of Cooling Systems at Nuclear Power Plants. Vienna; International Atomic Energy Agency (Feb 1975).

From symposium on the physical and biological effects on the environment of cooling systems and thermal discharges at nuclear power stations; Oslo, Norway (26 Aug 1974). See STI/PUB-378; CONF-740820-.

Temperature measurements of condenser discharge have been made at two nuclear station sites at outfall and in the mixing streams. At the coastal site at Tarapur, the discharges move through land-based canals but temperature drop in the canals depends on prevalent tidal conditions. Apart from tidal conditions seasonal climatic variations are also of interest in that they contribute to thermal abatement at the site. Seasonal and diurnal temperature changes are greater at the inland site of the Rajasthan Atomic Power Station (RAPS). The influence of thermal discharges

in lowering the dissolved oxygen content at selected points and the possible side effects are reported. The measurements at discharge points have been made by spot checks with thermometers with an accuracy of 0.1°C. Off-shore readings have been made with a recorder for differential and absolute measurements with a sensitivity of 0.05°C. The effect of seasonal high temperature at Rajasthan on stratification and lake turnover is of great interest in this evaluation. There is a predominant diluting action from semi-diurnal tides at Tarapur in strong winds. In the inland site the lake waters are stagnant and the local aspects are likely to be more accentuated. The dissolved oxygen and the organic load in the aquatic environment can be sensitive indicators of the overall behavior of thermal discharges and pollution in the environment. (auth)

8265 UNITED KINGDOM EXPERIENCE OF THE PHYSICAL BEHAVIOR OF HEATED EFFLUENTS IN THE ATMOSPHERE AND IN VARIOUS TYPES OF AQUATIC SYSTEMS. Spurr, G.; Scriven, R. A. (Central Electricity Generating Board, London). pp 227-248 of Environmental Effects of Cooling Systems at Nuclear Power Plants. Vienna; International Atomic Energy Agency (Feb 1975).

From symposium on the physical and biological effects on the environment of cooling systems and thermal discharges at nuclear power stations; Oslo, Norway (26 Aug 1974). See STI/PUB-378; CONF-740820-.

The cooling processes employed by the Central Electricity Generating Board in England and Wales have developed as a consequence of the country's high load density and the inadequacy of available water inland for direct cooling purposes. The Board has been able to take advantage of the long coastline and large tidal range in siting power stations on the coast and in estuaries. All major power stations located inland are equipped with natural-draught cooling towers. The paper describes studies which have been made of the cooling capacity of water bodies by heat exchange with the atmosphere. Consideration is given to the physical effects of large discharges of cooling water at coastal locations. From long experience in the use of natural-draught cooling towers, the environmental effects of tower operation are described. (auth)

8266 ANALYSIS OF THREE YEAR'S COMPLETE FIELD-TEMPERATURE DATA FROM DIFFERENT SITES OF HEATED SURFACE DISCHARGES INTO LAKE MICHIGAN. Kyser, J. M. (Argonne National Lab., IL); Paddock, R. A.; Policastro, A. J. pp 249-309 of Environmental Effects of Cooling Systems at Nuclear Power Plants. Vienna; International Atomic Energy Agency (Feb 1975).

From symposium on the physical and biological effects on the environment of cooling systems and thermal discharges at nuclear power stations; Oslo, Norway (26 Aug 1974). See STI/PUB-378; CONF-740820-.

Temperature data taken from prototype thermal plumes from single (and, in one case, double) surface outfalls under varying environmental conditions have been systematically analyzed. Three-dimensional temperature data were taken at four sites on Lake Michigan by an instrument-equipped boat. In total, 15 plumes from Palisades, 22 from Point Beach Unit 1, six from Point Beach Units 1 and 2, two from Waukegan and one from State Line were analyzed in terms of their major plume characteristics. Of most significance to plume dispersion at these sites were current speed and direction, wind speed and direction, and ambient lake turbulence. Plume characteristics of centerline temperature decay, temperature half-widths, and isotherm areas showed wide variation at a site as environmental conditions changed from one plume to the next. It was also found, however, that the Palisades and Point Beach Unit 1 data each fit rather neatly into five categories distinguished by ranges in current, wind, and lake conditions. Plumes from the above four sites were compared for similar environmental conditions (stagnant or small ambient currents). The Waukegan site demonstrated the most rapid plume dilution in terms of centerline temperature decay and isotherm areas due to its large outfall densimetric Froude number (≈9.7). The State Line site with its low initial densimetric Froude number (≈1) showed the least rapid plume dispersion. The Point Beach Unit 1 and Palisades discharges, although having nearly equal heat-rejection rates and initial densimetric Froude numbers (≈2.4), had significantly differing plume characteristics owing to the large outfall aspect ratio difference and secondarily upon the magnitude of site-dependent ambient currents. The Palisades plumes had a generally slower centerline temperature decay and larger areas than Point Beach owing mainly to its much larger aspect ratio. (auth)

8267 WASTE-HEAT DISPOSAL FROM STEAM-ELECTRIC PLANTS WITH REFERENCE TO THE STOCHASTIC NATURE OF SOME ENVIRONMENTAL CONDITIONS AND TO THERMAL POLLUTION CONTROL REGULATIONS. Mesarovic, M. M. (Energoprojekt, Belgrade). pp 311-330 of Environmental Effects of Cooling Systems at Nuclear Power Plants. Vienna; International Atomic Energy Agency (Feb 1975).

From symposium on the physical and biological effects on the environment of cooling systems and thermal discharges at nuclear power stations; Oslo, Norway (26 Aug 1974). See STI/PUB-378; CONF-740820-.

An analysis is performed of the environmental impact of waste-heat discharges from steam-electric plants, both with once-through cooling or with cooling towers, either natural or forced draught. Thermal pollution control regulations and water-temperature standards are discussed. Emphasis is placed on the siting criteria established on these standards. Deterministic and probabilistic policies are recognized. Special attention is paid to the stochastic nature of some environmental conditions such as random departures from normal air and water temperatures, water flow-rates, relative humidity, etc. Qualitative probabilities of occurrence and duration are shown as calculated for typical river and ambient air conditions in the northeast region of Yugoslavia. Management of waste-heat discharges from a nuclear plant and a nearby fossil-fired plant to the same water body is demonstrated. Water-temperature distribution upon discharges of heat was calculated in terms of heat dissipated to the atmosphere and related to an upper limit of 28°C. Both deterministic and probabilistic analyses were carried out for evaluating the once-through cooling capability of a water body. The probabilistic approach proved to be more realistic and resulted in a Farmer's type curve as siting criterion for design and planning purposes. (auth)

8268 MODEL FOR SALT DRIFT DEPOSITION FROM SPRAY PONDS. Guyer, E. C.; Golay, M. W. (Massachusetts Inst. of Tech., Cambridge). pp 331-345 of Environmental Effects of Cooling Systems at Nuclear Power Plants. Vienna; International Atomic Energy Agency (Feb 1975).

From symposium on the physical and biological effects on the environment of cooling systems and thermal discharges at nuclear power stations; Oslo, Norway (26 Aug 1974). See STI/PUB-378; CONF-740820-.

An approach to the drift-droplet dispersion problem is proposed and applied to salt-water spray pond systems. The mathematical model developed to predict downwind salt deposition is based on a stepwise non-turbulent trajectory calculation and allows for a detailed accounting of variations in the transport parameters over the trajectories of individual drift droplets. The direct application of the model, however, has been hindered by the present inability to describe the drift-droplet source in a typical large spray device. Sensitivity studies using the proposed model indicate strong dependence of the downwind salt deposition on plume humidity, wind speed, spray height, and drift-droplet size spectrum. The available field measurements of spray pond drift are assessed in relation to the model. (auth)

8269 TOTAL HEAT EXCHANGE COEFFICIENT OF SURFACE WATERS. Guenneberg, F. (Bundesanstalt fuer Gewaesserkunde, Coblenz). pp 347-355 of Environmental Effects of Cooling Systems at Nuclear Power Plants. Vienna; International Atomic Energy Agency (Feb 1975).

From symposium on the physical and biological effects on the environment of cooling systems and thermal discharges at nuclear power stations; Oslo, Norway (26 Aug 1974). See STI/PUB-378; CONF-740820-.

The total heat-exchange coefficient, A, together with either water depth or river discharge, yields the relaxation time or the relaxation surface which describes temperature developments by exponential functions. Four methods to evaluate A are introduced and a number of examples are given. The universality of these A's must be investigated. (auth)

8270 TWO METHODS OF MEASURING THE HEAT DISSIPATION OF DISCHARGED COOLING WATER: A PHENOMENOLOGICAL APPROACH. Sweers, H. E. (Dutch Electric Utilities, Arnhem, Netherlands). pp 357-367 of Environmental Effects of Cooling Systems at Nuclear Power Plants. Vienna; International Atomic Energy Agency (Feb 1975).

From symposium on the physical and biological effects on the environment of cooling systems and thermal discharges at nuclear power stations; Oslo, Norway (26 Aug 1974). See STI/PUB-378; CONF-740820-.

Two methods are described to measure the coefficient of heat exchange at the air-water interface: the heat-wave and the natural temperature methods. The Amsterdam-Rhine canal affords an excellent opportunity to evaluate these methods. Two power plants discharge into the canal cooling water, which is slowly carried northwards by a fairly consistent residual current of approximately 3 km/d. The movement and decay of the heat waves along the canal is followed and used to calculate the heat-exchange

coefficient. Daily variations in the natural temperature of the canal, in a location not influenced by the power plants, are correlated to the daily mean difference between air and water temperature. This method is evaluated in order to study its applicability elsewhere. It is mainly interesting for two reasons: (1) the necessary data can be collected with relatively simple instrumentation; and (2) the method can generally be applied to any reasonably well-mixed body of water. (auth)

8271 THERMAL DISCHARGE STUDIES ON THE GREAT LAKES: THE CANADIAN EXPERIENCE. Effer, W. R.; Bryce, J. B. (Ontario Hydro, Toronto). pp 371-388 of Environmental Effects of Cooling Systems at Nuclear Power Plants. Vienna; International Atomic Energy Agency (Feb 1975).

From symposium on the physical and biological effects on the environment of cooling systems and thermal discharges at nuclear power stations; Oslo, Norway (26 Aug 1974). See STI/PUB-378; CONF-740820-.

To meet the economic growth of the province, Ontario Hydro has a construction program which relies heavily on the CANDU system for generating electricity. It is planned to use the Great Lakes for once-through cooling, and the Provincial Government guidelines are outlined. At new and proposed stations and heavy-water plants, cooling water will be withdrawn via an off-shore submerged intake and discharged to the lake surface at or near the shoreline. A phenomenological model has been developed from on-site measurements which predicts thermal plumes under a range of conditions. Large physical models of sites now solve problems of temperature distribution. Biological studies at the Pickering site indicated that benthic fauna diversity was consistently but not significantly lower in the immediate discharge area. Seasonal variation in diversity was low, however, suggesting that community stability was not reduced. Fish populations were dominated by the brown bullhead, which had a short residence time in the heated area. Periphyton growth was enhanced by increased currents and temperature. At the Bruce site, most fish species were attracted to the Douglas Point discharge in the spring and autumn months but left in summer when temperatures exceeded their final preferenda. In winter, most cold- and warm-water species migrated from the shoreline. Benthic fauna populations decreased slightly, possibly due to hydrogen sulphide releases from the heavy-water plant. A feasibility study on the use of warm water for promoting crop growth indicates that the economics critically depend on the distance between the generating station and area to be heated. (auth)

8272 ECOLOGY OF ARTIFICIALLY HEATED STREAMS, SWAMPS, AND RESERVOIRS ON THE SAVANNAH RIVER PLANT: THE THERMAL STUDIES PROGRAM OF THE SAVANNAH RIVER ECOLOGY LABORATORY. Gibbons, J. W.; Sharitz, R. R.; Howell, F. G.; Smith, M. H. (Savannah River Ecology Lab., Aiken, SC). pp 389-400 of Environmental Effects of Cooling Systems at Nuclear Power Plants. Vienna; International Atomic Energy Agency (Feb 1975).

From symposium on the physical and biological effects on the environment of cooling systems and thermal discharges at nuclear power stations; Oslo, Norway (26 Aug 1974). See STI/PUB-378; CONF-740820-.

The United States' operable nuclear production reactors are located on the Atomic Energy Commission's Savannah River Plant (SRP) in South Carolina. As none of the heat energy is used in power production, the heated effluents have been released into the environment at higher temperatures than those from power reactors since 1953. Since cooling towers are not in use, the high-temperature effluents are discharged directly into the aquatic ecosystems. This creates a variety of thermal habitats with temperatures ranging from normal for the area to above 50°C. Continued operation of these reactors has resulted in a unique outdoor laboratory for thermal studies. Post-thermal stream, swamp, and lake habitats, created by the temporary shutdown of two reactors, have provided the rare opportunity to examine the long-lasting effects of thermal loading once heated effluent is removed. Natural aquatic areas serve as control environments for the thermal field studies. The environmental effects of SRP thermal effluents are not confounded by synergies with chemical inputs as releases of industrial and domestic wastes into these thermal ecosystems on the SRP are minimal. The SREL Thermal Studies Program has been approached in a manner to utilize best the field potentials of the SRP. Studies have been undertaken in a variety of thermal habitats (both aquatic and terrestrial) and at all levels of biological organization from the individual to the community in order to extend understanding of ecosystem responses to thermal alteration. (auth)

8273 EFFECTS OF A THERMAL DISCHARGE INTO A RIVER ON THE MOVEMENT OF FISH POPULATIONS. Leynaud, G.; Allardi, J. (Centre Technique du Genie Rural, des Eaux et des Forets, Paris). pp 401-408 of Environmental Effects of Cooling Systems at Nuclear Power Plants. Vienna; International Atomic Energy Agency (Feb 1975). (In French).

From symposium on the physical and biological effects on the environment of cooling systems and thermal discharges at nuclear power stations; Oslo, Norway (26 Aug 1974). See STI/PUB-378; CONF-740820-.

To assess the effects of thermal discharges on fish populations a study was carried out in the Seine at the Montereau Thermal Power Station in collaboration with Electricité de France. Regular catches were made in the discharge channel of the power station using electrofishing and lobster pots. Labelling and subsequent re-catching in the Seine, with the assistance of amateur fishermen, made it possible to trace certain movements. The numbers caught in the discharge channel are subject to considerable variations (maxima in spring and autumn, minima in winter and summer), as is the composition of the populations (increase in the proportion of Cyprinidae during hot periods). Barbels (Barbus barbus) disappear during hot periods, whereas black bass (Micropterus salmoides) become more frequent when the water temperature is high. Some invertebrates (Gammaridae) also disappear during the summer. Efforts are being made to determine more precisely the overall ecological impact of the increase in water temperature. (auth)

8274 THERMAL STUDIES ON TROPICAL MARINE ECOSYSTEMS IN PUERTO RICO. Kolehmainen, S. E.; Martin, F. D.; Schroeder, P. B. (Puerto Rico Nuclear Center, Mayaguez). pp 409-422 of Environmental Effects of Cooling Systems at Nuclear Power Plants. Vienna; International Atomic Energy Agency (Feb 1975).

From symposium on the physical and biological effects on the environment of cooling systems and thermal discharges at nuclear power stations; Oslo, Norway (26 Aug 1974). See STI/PUB-378; CONF-740820-.

Studies have been conducted on zooplankton, micro- and macrobenthos, turtle grass beds, mangrove communities, and fish fauna in the vicinity of a 310-MW fossil-fuel power-generating plant that has been operating for two decades. The temperatures in the heated effluent varied from 35°C in the winter to 40°C in the summer, or 10°C above the ambient water temperature. (auth)

8275 ENVIRONMENTAL EFFECTS OF THE HEATED DISCHARGES FROM BRADWELL NUCLEAR POWER STATION, AND OF THE COOLING SYSTEMS OF OTHER STATIONS. Hawes, F. B. (Central Electricity Generating Board, London); Coughlan, J.; Spencer, J. F. pp 423-448 of Environmental Effects of Cooling Systems at Nuclear Power Plants. Vienna; International Atomic Energy Agency (Feb 1975).

From symposium on the physical and biological effects on the environment of cooling systems and thermal discharges at nuclear power stations; Oslo, Norway (26 Aug 1974). See STI/PUB-378; CONF-740820-.

A description is given of the investigations undertaken at Bradwell Nuclear Power Station following strong objections to its construction and operation. The studies were carried out to examine the environmental impact of this station. The heating of the area is described in relation to the natural temperatures. Selected marine organisms found in the area are listed and the effects of the severe winter of 1962/3 on the local oyster industry described. The possible effects on organisms entrained in a cooling system are discussed, and the hydraulic gradient described. A successful fish-handling system attached to fine screens is explained, and the problems of fish shoals are considered. Since the impact of cooling systems in all thermal power stations—whether fossil or nuclear fuelled—can be similar, the CEGB's experience at other stations is mentioned. In agreement with several other European countries, the authors maintain that to identify all warmed discharges as "thermal pollution" is incorrect. Such discharges can and are being planned so that the impact is minimal and the environment is being conserved. (auth)

8276 INFLUENCE OF HEAT FROM THE GENTILLY NUCLEAR POWER STATION ON WATER TEMPERATURE AND GASTROPODA. Vaillancourt, G.; Couture, R. (Univ., Quebec, Trois-Rivieres). pp 449-459 of Environmental Effects of Cooling Systems at Nuclear Power Plants. Vienna; International Atomic Energy Agency (Feb 1975). (In French).

From symposium on the physical and biological effects on the environment of cooling systems and thermal discharges at nuclear power stations; Oslo, Norway (26 Aug 1974). See STI/PUB-378; CONF-740820-.

The effects of an increase in water temperature caused by the operation of the Gentilly Nuclear Power Station on the physical characteristics of the environment and on some species of mollusc are discussed. The results show that when the reactor is operating at 480 MW(th) the increase in the temperature in the discharge

cone is 3.5°C; It is almost 10°C when the reactor is operating at maximum power. In the latter case, mortality among the molluscs increases to the point where they disappear completely. (auth)

8277 STUDIES CARRIED OUT IN FRANCE ON THE ECOLOGICAL CONSEQUENCES OF OPEN-CIRCUIT COOLING IN THERMAL POWER STATIONS. Khalanski, M. (Electricite de France, Chatou). pp 461-477 of Environmental Effects of Cooling Systems at Nuclear Power Plants. Vienna; International Atomic Energy Agency (Feb 1975). (In French).

From symposium on the physical and biological effects on the environment of cooling systems and thermal discharges at nuclear power stations; Oslo, Norway (26 Aug 1974). See STI/PUB-378; CONF-740820-.

Experience gained over a ten-year period concerning the influence of power-plant cooling in open circuit on flora and animal life in aquatic environment are described. (auth)

8278 BEHAVIORAL RESPONSES OF LAKE MICHIGAN FISHES TO A NUCLEAR POWER PLANT DISCHARGE. Spigarelli, S. A. (Argonne National Lab., IL). pp 479-498 of Environmental Effects of Cooling Systems at Nuclear Power Plants. Vienna; International Atomic Energy Agency (Feb 1975).

From symposium on the physical and biological effects on the environment of cooling systems and thermal discharges at nuclear power stations; Oslo, Norway (26 Aug 1974). See STI/PUB-378; CONF-740820-.

Since 1970, the USAEC has sponsored thermal effects research at Argonne National Laboratory. This program has developed into a detailed study of the behavior of Lake Michigan fishes in relation to waste-heat discharges from large power plants. Echo location techniques indicate that mean fish densities are similar in plume and reference areas, except during the spawning seasons of alewife and smelt when plume densities exceed reference area densities. Power plant shutdowns in July and September resulted in little change in fish density or distribution. Mark and recapture studies indicate that Lake Michigan salmonids are extremely migratory and generally do not reside in a thermal plume for long periods. Temperature-sensitive fish tags and measurements of fish-body temperatures indicate that salmonids which frequent the outfall area do not acclimate to maximum discharge temperatures. Sport fishing in thermal outfalls in Lake Michigan is quite popular and often provides unexcelled fishing for salmonids. Species composition of the catch and fishing success are partially dependent upon season and water temperature. (auth)

8279 THERMAL EFFECTS ON MARINE BIOTA IN EXPERIMENTAL SYSTEMS. Nilsen, G.; Kaellqvist, T. (Norwegian Inst. for Water Research, Oslo). pp 499-518 of Environmental Effects of Cooling Systems at Nuclear Power Plants. Vienna; International Atomic Energy Agency (Feb 1975).

From symposium on the physical and biological effects on the environment of cooling systems and thermal discharges at nuclear power stations; Oslo, Norway (26 Aug 1974). See STI/PUB-378; CONF-740820-.

Marine benthic communities that have been studied in artificial channels are described. Natural fjord water was used with ambient temperature in one channel and with ambient temperature plus 4°C in another channel. A shift in the algal communities to greater dominance by green and blue-green algae was observed in the heated channel. Among the animal species, Apherusa bispinosa was found only in the unheated channel. From 3/8 to 12/9, 1973, the increase in biomass in the algal dominated communities was the same in both channels, or slightly less in the warmer, but after 12/9 the growth was greatest in the warmer channel. The shrimp Arthanas nitescens had greatest growth in the warmed channel. The measurement of carbon assimilation of natural phytoplankton from the Oslofjord at different temperatures in an incubator is described. The experiments were carried out at different times of the year. It is shown that the effect of temperature on the productivity varies during the year, although a 2°C temperature increase always stimulated the production. In winter there is a clear tendency for temperature increases of both 2 and 6°C to give higher productivity than a 4°C increase. In May and August the productivity increased with temperature up to 4°C above the starting temperature. (auth)

8280 EFFECTS OF TEMPERATURE, COPPER, AND CHLORINE ON FISH DURING SIMULATED ENTRAINMENT IN POWER-PLANT CONDENSER COOLING SYSTEMS. Hoss, D. E.; Coston, L. C.; Baptist, J. P.; Engel, D. W. (Atlantic Estuarine Fisheries Center, Beaufort, NC). pp 519-527 of Environmental Effects of Cooling Systems at Nuclear Power Plants. Vienna; International Atomic Energy Agency (Feb 1975).

From symposium on the physical and biological effects on the environment of cooling systems and thermal discharges at nuclear power stations; Oslo, Norway (26 Aug 1974). See STI/PUB-378; CONF-740820-.

Most power plants located along the coast use once-through cooling in which water, along with entrainable organisms, is passed through the condensers and released back to the estuary or ocean at an elevated temperature. In addition to increased temperature, these entrained organisms are exposed to metal contaminants, chlorine biocides, and pressure changes. Conditions of entrainment were simulated in the laboratory to investigate the effects of thermal shock, the combined effects of thermal shock and copper, and the combined effects of thermal shock and chlorine on the survival of larval fish. A cycling acclimation temperature was found to reduce the effects of thermal shock on larval pinfish. Survival of pinfish held for 24 hours in water containing 1.0 ppM copper prior to thermal shock was significantly reduced at shock temperatures of 12 and 15°C above acclimation temperatures. Flounder, Atlantic menhaden, and striped mullet safely withstood limited exposure to 0.3 ppM chlorine at ambient temperature: up to 5 min for mullet and flounder, and up to 7 min for menhaden. Reductions in survival occurred at exposures longer than the above, and further reductions occurred with the addition of heat. Survival was reduced still further at chlorine concentrations of 0.5 ppM, in some cases at ambient temperatures. The experiments indicate that the interaction between heat and chlorine is synergistic. (auth)

8281 EFFECTS OF HEAT ENRICHMENT ON SPECIES SUCCESSION AND PRIMARY PRODUCTION IN FRESH-WATER PLANKTON. McMahon, J. W.; Docherty, A. E. (Atomic Energy of Canada Ltd., Chalk River, Ont.). pp 529-546 of Environmental Effects of Cooling Systems at Nuclear Power Plants. Vienna; International Atomic Energy Agency (Feb 1975).

From symposium on the physical and biological effects on the environment of cooling systems and thermal discharges at nuclear power stations; Oslo, Norway (26 Aug 1974). See STI/PUB-378; CONF-740820-.

Sublethal effects of heat enrichment were studied on a natural plankton community in a northern, temperate lake. Species composition and numbers of organisms were determined twice weekly on populations of phytoplankton and zooplankton subjected to artificial thermal loading in a polyethylene cylinder located in the lake. Thirty species of phytoplankton and 17 species of zooplankton were quantitatively studied during the summer period. Three Chrysophyceae and two Diatomae responded negatively to increased water temperatures in the late spring. Three Rotifera increased significantly in numbers in the heated column. A Chlorophyta appeared in large numbers in the heated water in mid-summer. Carbon-14 primary productivity (PP) values might be regarded as accurate indices for evaluating thermal effects on phytoplankton. Increased PP values in one instance were correlated with increased numbers of Ankistrodesmus while other high mid-summer values might be related to nannoplankton production. Results are discussed in terms of normal seasonal succession patterns for fresh-water plankton and possible interactions between different environmental factors. (auth)

8282 AQUATIC PHYSIOLOGY OF THERMAL AND CHEMICAL DISCHARGES. Schneider, M. J.; Becker, C. D.; Fickeisen, D. H.; Thatcher, T. O.; Wolf, E. G.; Hunt, E. L. (Battelle Memorial Inst., Richland, WA). pp 547-561 of Environmental Effects of Cooling Systems at Nuclear Power Plants. Vienna; International Atomic Energy Agency (Feb 1975).

From symposium on the physical and biological effects on the environment of cooling systems and thermal discharges at nuclear power stations; Oslo, Norway (26 Aug 1974). See STI/PUB-378; CONF-740820-.

The United States Atomic Energy Commission has been operating the Hanford Works in Washington State, USA, since the 1940s. Throughout this time, investigations of the ecological effects of reactor discharges have been conducted by the scientists of the Pacific Northwest Laboratories. Over the years, the content and investigative approaches have changed to reflect the national interests and needs. The topics, approaches, and some of the significant findings of the on-going work are described. Five major project areas are: (1) the effects of fatigue on thermal tolerance in fish, (2) the behavioral response of fish influenced by thermal plumes and the effect of thermal experience on fish sensory physiology, (3) the effects of heat and gas supersaturation on fish, (4) the effects of "cold shock" on fish, and (5) the effects of heat and pollutant chemicals on fish. (auth)

8283 THERMAL ECOLOGY OF DRAGONFLIES IN HABITATS RECEIVING REACTOR EFFLUENT. Gentry, J. B.; Garten, C. T. Jr.; Howell, F. G.; Smith, M. H. (Savannah River Ecology Lab., Aiken, SC). pp 563-574 of Environmental Effects of Cooling Systems at Nuclear Power Plants. Vienna; International Atomic Energy Agency (Feb 1975).

From symposium on the physical and biological effects on the environment of cooling systems and thermal discharges at nuclear

power stations; Oslo, Norway (26 Aug 1974). See STI/PUB-378; CONF-740820-.

On the Savannah River Plant in the southeastern United States of America both the numbers of individuals and the species of dragonfly nymphs are reduced when thermal effluent from a nuclear reactor is received by a stream or pond. Surviving genera belong to the sub-family Libellulinae. Mortality is complete for the remaining families and sub-families. Some species are probably eliminated by the direct effects of increased water temperature. Others are reduced in numbers, or eliminated indirectly owing to habitat alterations. Nymphs in the thermal effluent stream and ponds survive extended periods in relatively constant water temperatures interrupted by short periods of sudden temperature changes and water-level fluctuations. Dragonfly nymphs from thermally stressed streams have a higher thermal tolerance than nymphs from natural streams. Higher thermal tolerance is reflected by a significantly higher critical thermal maximum (CTM) and a higher lethal temperature (LT) at different acclimation temperatures. Acclimation temperature, habitat and body size are significant variables in determining thermal tolerances of nymphs from natural and heated aquatic environments. High acclimation temperatures lead to higher thermal preferences while lower acclimation temperatures encourage ambulations through a wider range of temperatures. Mechanisms permitting the survival of dragonfly populations under thermally stressed conditions may include both physiological acclimatization to higher temperatures and directional selection for higher thermal tolerance. (auth)

8284 TEMPERATURE SELECTION BY FISH: A FACTOR IN POWER-PLANT IMPACT ASSESSMENTS. Coutant, C. C. (Oak Ridge National Lab., TN). pp 575-597 of Environmental Effects of Cooling Systems at Nuclear Power Plants. Vienna; International Atomic Energy Agency (Feb 1975).

From symposium on the physical and biological effects on the environment of cooling systems and thermal discharges at nuclear power stations; Oslo, Norway (26 Aug 1974). See STI/PUB-378; CONF-740820-.

The tendency of fish to select certain temperatures in thermal gradients is viewed as an important response of fish to heated effluents. Current information on temperature selection is summarized, including final temperature preferenda and upper and lower avoidance temperatures for a variety of fishes. Electrofishing surveys near a power station in Tennessee, USA, indicate that several freshwater fishes, notably the gizzard shad, are attracted to heated effluent in early spring but are dispersed when the heated discharge is terminated. Acoustic temperature telemetry indicates that wild largemouth bass have a final temperature preferendum of about 27°C. Knowledge of species-specific temperature preference and avoidance, along with an understanding of abundance and composition of local fish populations at a power plant site, should be used in designing thermal discharges which will have a minimum impact on fish populations. (auth)

8285 PREDICTING THE ECOLOGICAL CONSEQUENCES OF THERMAL POLLUTION FROM OBSERVATIONS ON GEOTHERMAL HABITATS. Brock, T. D. (Univ. of Wisconsin, Madison). pp 599-622 of Environmental Effects of Cooling Systems at Nuclear Power Plants. Vienna; International Atomic Energy Agency (Feb 1975).

From symposium on the physical and biological effects on the environment of cooling systems and thermal discharges at nuclear power stations; Oslo, Norway (26 Aug 1974). See STI/PUB-378; CONF-740820-.

Observations on the ecology of organisms in hot springs and other geothermal habitats are used to derive a set of general principles for predicting the ecological consequences of thermal pollution. The advantages of using geothermal habitats for such studies is that they are natural, stable, and of long duration. There are distinct upper temperature limits for different groups of organisms: fish and other aquatic vertebrates, 38°C; insects, 45 to 50°C; protozoa, 50°C; vascular plants, 45°C; mosses, 50°C; eucaryotic algae, 56°C; fungi, 60°C; blue-green algae, 70 to 73°C; bacteria, >99°C. Thus, increases in temperature can lead to a greatly simplified ecosystem structure. Even at temperatures below the upper limit for a group of organisms, the species diversity for this group may be severely restricted. A temperature of 40°C is seen as critical, since rises above this will eliminate most higher organisms as well as eucaryotic algae, and only blue-green algae and bacteria will be able to grow. Careful consideration should be given to the natural temperature fluctuation of the habitat receiving thermal water, since thermal pollution may have much greater effects in summer than in winter, especially in temperate habitats. Tentative recommendations for siting power plants to avoid serious ecological consequences are given. (auth)

8286 COMPARISON OF SHORT-TERM EFFECTS OF THERMAL ADDITION ON PHOTOSYNTHESIS AND PLANT-WATER STRESS IN THREE ECOSYSTEMS. Miller, P. C. (San Diego State Univ., CA). pp 623-636 of Environmental Effects of Cooling Systems at Nuclear Power Plants. Vienna; International Atomic Energy Agency (Feb 1975).

From symposium on the physical and biological effects on the environment of cooling systems and thermal discharges at nuclear power stations; Oslo, Norway (26 Aug 1974). See STI/PUB-378; CONF-740820-.

Some potential short-term responses of primary production and plant-water stress are compared to thermal additions in arctic tundra at Barrow, Alaska, chaparral in southern California, and mangrove in south Florida. The comparisons are made with a simulation model which was developed in field research in each ecosystem. The tundra has a short growing season with 24-hour daylight and sub-optimal temperatures. The chaparral has a potential 365-day growing season, limited by water in summer and cool temperatures in winter. Temperatures at the soil surface are supra-optimal in the summer. The mangrove has a 365-day growing season with sub-optimal temperatures in winter and supra-optimal temperatures in summer. Water is available throughout the year. In all three simulated systems, increasing air temperatures had greater effect than increasing ground surface temperature. Increasing both air and ground temperatures had effects similar to increasing air temperature alone. Mangroves showed the greatest changes in production, but chaparral showed the greatest changes in water stress with changing temperatures. Mangrove sensitivity occurs because they are active in the summer when supra-optimal temperatures occur. Chaparral is relatively inactive in the hot season because of the limitation by water. Arctic tundra plants are relatively insensitive to temperature at low temperatures, so that increasing temperatures in the low temperature range did not change production markedly. (auth)

8287 DEVELOPMENT AND APPLICATION OF CRITERIA FOR MARINE COOLING WATERS. Miller, D. C.; Beck, A. D. (Environmental Protection Agency, Narragansett, RI). pp 639-657 of Environmental Effects of Cooling Systems at Nuclear Power Plants. Vienna; International Atomic Energy Agency (Feb 1975).

From symposium on the physical and biological effects on the environment of cooling systems and thermal discharges at nuclear power stations; Oslo, Norway (26 Aug 1974). See STI/PUB-378; CONF-740820-.

Principles are advanced for the development of general criteria for safe levels of thermal addition for coastal marine ecosystems. Applicability of published studies on tolerance limits and sublethal thermal stress is examined, along with the array of biological and environmental variables which must be considered in the evaluation of these data. Newly proposed temperature criteria for marine waters of the United States of America are presented, with a summary of supportive rationale. When implementing thermal criteria, it is necessary to consider the cooling-water process as a unit in order to ensure minimum impact on the total environment. Discharge temperature standards can be met by increasing cooling-water volume. This practice, termed dilution pumping, can add appreciable stress to the marine system owing to mortality of entrained plankton and juvenile fishes. The problem of inner-plant entrainment damage is detailed. Recommendations for implementing thermal criteria include prohibiting dilution pumping in most cases to meet standards, siting the discharge on well-mixed waters and using near-bottom diffusers to achieve efficient dissipation of heat. Some general guidelines regarding thermal mixing zones are also presented. (auth)

8288 REGULATIONS AND ENVIRONMENTAL INVESTIGATIONS ASSOCIATED WITH NUCLEAR STATION THERMAL DISCHARGES. Bramati, L.; Gasparini, R.; Merluzzi, D. (ENEL-Direzione delle Costruzioni, Rome). pp 659-673 of Environmental Effects of Cooling Systems at Nuclear Power Plants. Vienna; International Atomic Energy Agency (Feb 1975).

From symposium on the physical and biological effects on the environment of cooling systems and thermal discharges at nuclear power stations; Oslo, Norway (26 Aug 1974). See STI/PUB-378; CONF-740820-.

The operating experience at the Italian nuclear power stations from the standpoint of thermal discharges is described. A detailed investigation program is being implemented at the Caorso nuclear power station, based on the results of hydraulic model tests. This program and its purposes are described. Mention is made of the present regulations governing thermal discharges in Italy, and possible areas of improvement are indicated. Plans for environmental protection against thermal effects of future ENEL plants are discussed. (auth)

8289 COMPARATIVE EFFECTS OF TWO MODES OF COOLING-WATER DISCHARGE ON MISSISSIPPI RIVER BIOTA AND ENVIRONMENTAL ECOSYSTEMS. Eiler, H. O.; Delfino, J. J. (Industrial BIO-Test Labs., Inc., Northbrook, IL). pp 685-692 of Environmental Effects of Cooling Systems at Nuclear Power Plants. Vienna; International Atomic Energy Agency (Feb 1975).

From symposium on the physical and biological effects on the environment of cooling systems and thermal discharges at nuclear power stations; Oslo, Norway (26 Aug 1974). See STI/PUB-378; CONF-740820-.

Environmental studies during operation of two different modes of once-through condenser cooling at the Quad-Cities Nuclear Power Plant on the Mississippi River are reported. During operation of an interim shoreline discharge numerous localized changes in biotic communities downstream from the point of discharge compared with pre-operational data were detected. Water temperatures greater than 7°C (44.6°F) above ambient and chlorine concentrations of 0.22 ppM were believed to be responsible for adverse affects to downstream biological communities, such as periphyton inhibition and fish displacement. A submerged multi-port diffuser-pipe system provided an alternative method for discharging the heated effluent. Limnological studies during 18 months of station operation, using the diffuser pipe discharge mode, indicated virtually complete mixing of the thermal effluent with ambient river water and subsequent recovery of the previously impacted area. Entrainment studies during this 18-month period showed no adverse impact on river plankton. However, large numbers of gizzard shad were impinged on the travelling intake screens. These fishes were mostly young-of-the-year and juveniles and their impingement was not considered to have a detectable impact on the fishery of the area. A 4-km closed-cycle spray-cooling-canal system is at present in use at the Quad-Cities Station for one of the two boiling-water reactors. This closed-cycle system was placed into operation because of legal agreements with regulatory and conservation groups prior to analysis of data regarding operational efficiency of the open-cycle diffuser-pipe discharge mode. (auth)

8290 WASTE-HEAT AND NUTRIENT-LOADED EFFLUENTS IN THE AQUACULTURE: REPORT ON THE WORKSHOP HELD AT SOLSTRAND NEAR BERGEN FROM 24 TO 28 FEBRUARY 1974. Devik, O. (Christian Michelsens Inst., Bergen). pp 693-702 of Environmental Effects of Cooling Systems at Nuclear Power Plants. Vienna; International Atomic Energy Agency (Feb 1975).

From symposium on the physical and biological effects on the environment of cooling systems and thermal discharges at nuclear power stations; Oslo, Norway (26 Aug 1974). See STI/PUB-378; CONF-740820-.

The purpose of the workshop was to assess the concept of integrated aquaculture in the utilization of waste heat and the recycling of waste mineral nutrients by controlled eutrophication and its biological and technical aspects, to consider the possibilities of reaching practical solutions, and to define objects of pertinent research and developments. Briefly, the most important conclusions are: (1) the concept of the combined utilization of waste heat and minerals from effluents is useful; (2) technical solutions are not immediately available, there is still a need to develop suitable methods for handling a large amount of water; and also a definite need to define types of activities other than the rearing of fish or aquatic herbivores (filter feeders); (3) the available data indicate that the traditional approach leads to solutions that are unacceptable as regards investment and labor costs. Little assessment exists concerning the suitability of alternate photosynthetic organisms which are harvestable, and a systematic search for such organisms is desirable. The criteria for suitability should be: Efficiency of the photosynthetic pathway; ability to grow at high nutrient concentrations; resistance to temperature fluctuations; ease of harvesting; and scope of utilization (for feeding marine grazers, feed in animal husbandry, direct human consumption, etc.); (4) the strategy of utilization should be to adjust the methods to the geographic latitude of the site. In particular, in sub-arctic and cool temperate climates allowance has to be made for low or non-existent photosynthetic activity during the winter season. On one side this would mean to accept, for the time being, systems with low conversion efficiency, where practical solutions are imminent. It is primarily in cool climates that a combined utilization seems to be most interesting, and a systematic scrutiny of ecosystems of the warm temperate and sub-tropic zones would be useful. (auth)

8291 USE OF HEAT FROM THERMAL DISCHARGES IN AGRICULTURE, PISCICULTURE AND SPACE HEATING. Balligand, P.; Grauby, A.; Fourcy, A.; de Cachard, M. B.; Dumont, M. (Commissariat a l'Energie Atomique, Paris). pp 717-730 of Environmental Effects of Cooling Systems at Nuclear Power Plants. Vienna; International Atomic Energy Agency (Feb 1975). (In French).

From symposium on the physical and biological effects on the environment of cooling systems and thermal discharges at nuclear power stations; Oslo, Norway (26 Aug 1974). See STI/PUB-378; CONF-740820-.

A pilot site for studying the utilization of hot water discharged by nuclear power stations has been set up at the Cadarache Centre for Nuclear Studies. The site has facilities to convey heat from the reactor to the test plots to simulate the thermal discharges which are characteristic of most power stations. Forestry trials are being carried out with conifers and deciduous trees. Open farming studies are being made of certain factors which might disturb the ecology. The possibilities of utilizing thermal discharges are being investigated with fish species selected for their physiological characteristics and their economic value. The most profitable rearing conditions will be determined by making regular checks on the growth of the fish and on their response to artificial feeding. Research being carried out at the Grenoble Centre for Nuclear Studies includes heating of greenhouses and space heating. (auth)

8292 EXPLOITATION OF WASTE HEAT. Hatle, Z. (Atomic Energy Commission, Prague); Lampar, M. pp 731-740 of Environmental Effects of Cooling Systems at Nuclear Power Plants. Vienna; International Atomic Energy Agency (Feb 1975).

From symposium on the physical and biological effects on the environment of cooling systems and thermal discharges at nuclear power stations; Oslo, Norway (26 Aug 1974). See STI/PUB-378; CONF-740820-.

The extensive production of electricity creates a problem of waste heat. About two-thirds of generated heat is lost into the environment. This problem is even more serious with large nuclear power plants, especially if they are congregated at one site. About 12,000 MW(e) capacity will be available in the CSSR by 1990 from pressurized-water reactors, VVER 440-MW(e) units and VVER 1000-MW(e) units. Waste heat from the 440-MW(e) VVER amounts to about 800 MW(th), and from the 1000-MW(e) VVER to about 2000 MW(th). The vast amount of waste heat can be decreased by the use of a combined nuclear power plant, producing heat and electricity, which will be used to supply large cities with heat and hot water. Thus the produced heat would be distributed over a large area and the negative factors of waste heat would be substantially lessened. Heat parameters for district heating and the production of hot water are higher (150°C, 12 to 15 bars) than waste-heat parameters (20 to 40°C, 1 bar), but the efficiency of the combined thermal cycle is significantly raised to 90%. Waste heat (low-potential heat), produced in condensers of NPP can be used beneficially for (a) farming (greenhouses, soil heating, irrigation); (b) cattle raising; (c) mushroom growing; (d) pond heating for intensive fish breeding; (e) recreation purposes (heating swimming pools, increasing river temperature, etc.); (f) drying vegetables and fruits. Calculation of heat requirements and conditions for some of these uses are presented. Designs of combined nuclear power plants have been worked out for the cities of Brno, Prague, and Olomouc. At all sites the exploitation of waste heat was included. The combined nuclear power plant of Olomouc has been designed as an agricultural complex and is described in more detail. (auth)

8293 PROSPECTS FOR APPLYING VARIOUS METHODS OF COOLING NUCLEAR POWER STATIONS AND UTILIZING WASTE HEAT IN THE USSR. Ageev, G. S. (Inst. of Thermal Power Engineering, Moscow); Lapshin, M. M. pp 741-748 of Environmental Effects of Cooling Systems at Nuclear Power Plants. Vienna; International Atomic Energy Agency (Feb 1975). (In Russian).

From symposium on the physical and biological effects on the environment of cooling systems and thermal discharges at nuclear power stations; Oslo, Norway (26 Aug 1974). See STI/PUB-378; CONF-740820-.

An evaluation of the practical possibilities of using various cooling systems for nuclear power stations in the USSR shows that, from the point of view of environmental protection, a combination of the air-evaporation cooling system and the air-water cooling system merits special attention. The productive utilization of low-temperature waste heat is a topical problem, and in particular warm water may be used in the fishing industry and to heat hothouses and seed-beds. (auth)

8294 EVALUATION AND BIOLOGICAL FIELD SURVEYS RELATED TO THE SITING OF THE FIRST NORWEGIAN NUCLEAR POWER PLANT. Haugen, I. (Norwegian Inst. of Water Research, Oslo). pp 751-760 of Environmental Effects of Cooling Systems at Nuclear Power Plants. Vienna; International Atomic Energy Agency (Feb 1975).

From symposium on the physical and biological effects on the environment of cooling systems and thermal discharges at nuclear

power stations; Oslo, Norway (26 Aug 1974). See STI/PUB-378; CONF-740820-.

The regions suitable for siting a nuclear power plant are discussed. The biological problems arising in connection with siting a nuclear power plant in the Oslo Fjord have been investigated, and the biological guidelines for recipient evaluation are discussed. The benthic flora and fauna were used to assess water quality. This, together with information about the hydrographical conditions, laboratory experiments and other field investigations, are used to evaluate the three potential sites for a nuclear power plant in the Oslo Fjord. (auth)

8295 CONSIDERATION OF THERMAL PROBLEMS IN ECOLOGICAL AND HEALTH STUDIES PRIOR TO THE SELECTION OF SITES. Bovard, P.; Lacourly, G.; Coulon, R. (CEA, Fontenay-aux-Roses, France). pp 761-769 of Environmental Effects of Cooling Systems at Nuclear Power Plants. Vienna; International Atomic Energy Agency (Feb 1975). (In French).

From symposium on the physical and biological effects on the environment of cooling systems and thermal discharges at nuclear power stations; Oslo, Norway (26 Aug 1974). See STI/PUB-378; CONF-740820-.

The need to reconcile economic development with considerations of public health and environmental protection means that the people responsible for projects must study site-environment interactions. The purpose of site studies from a radiological protection point of view is to provide the information necessary for minimizing the impact of a nuclear facility, for determining practical measures to control radiation effects or to make them acceptable, and for achieving optimum conditions for the establishment of the facility with due account taken of the environmental constraints while ensuring that the facility will be able to operate. In the case of nuclear power stations, site studies should serve the same purpose with regard to thermal discharges. Thermal discharges are considered in the light of the three ways in which they may have an impact: effects of heat on the biosphere; indirect effects of heat through its influence on radionuclide transfer mechanisms or its acting synergistically together with conventional pollutants; effects of the cooling system chosen on the site characteristics, with the possible consequences for subsequent operation of the site. (auth)

8296 DEVELOPMENT OF A GUIDE FOR AQUATIC ECOLOGICAL SURVEYS. Hartman, R. M. (Bechtel Power Corp., Gaithersburg, MD). pp 771-784 of Environmental Effects of Cooling Systems at Nuclear Power Plants. Vienna; International Atomic Energy Agency (Feb 1975).

From symposium on the physical and biological effects on the environment of cooling systems and thermal discharges at nuclear power stations; Oslo, Norway (26 Aug 1974). See STI/PUB-378; CONF-740820-.

At present there is confusion in the United States of America regarding the scope and detail of aquatic ecology information supplied by or requested from electric utilities for new power plants. A joint American Nuclear Society sponsored subcommittee is working on ways of unravelling some of the confusion in this area. An outline of the development of the approach being taken by this subcommittee is presented. The approach starts out with a consideration of the basic needs of aquatic ecological studies, and goes on to explain a matrix approach developed to supply guidance for the scope and detail of aquatic ecological studies to those responsible for such studies. An example of the application of the matrix to a specific survey stage is supplied. (auth)

8297 IMPACT OF THERMAL DISCHARGES ON THE ECOSYSTEM OF THE AUSTRIAN DANUBE: PRESENT SITUATION AND FUTURE DEVELOPMENT. Ottendorfer, L. J. (Federal Inst. for Water Biology and Waste Water Research, Vienna). pp 785-794 of Environmental Effects of Cooling Systems at Nuclear Power Plants. Vienna; International Atomic Energy Agency (Feb 1975).

From symposium on the physical and biological effects on the environment of cooling systems and thermal discharges at nuclear power stations; Oslo, Norway (26 Aug 1974). See STI/PUB-378; CONF-740820-.

In Austria the construction of hydroelectric power plants reduces the Danube flow-rates from 2.5 to approximately 0.5 m/s. Increasing amounts of thermal discharges from industry and energy generation raise the natural temperature of the river. Both factors affect the existing aquatic ecosystems considerably. Studies initiated by the government should yield the information necessary for further planning of electric power stations. It has to be decided as soon as possible to what extent fresh-water cooling—especially for nuclear plants—can be used without upsetting the biological equilibrium of the Danube. A description is given of studies that have been started in the collection of physical, meteorological and hydrographic data of the Danube: preparation of a mathematical model of temperature development under different conditions including future thermal load from cooling-water discharges. Biological research includes in-situ studies on smaller overheated rivers and laboratory studies of bio-degradation rates at various temperatures. In addition estimates have been made of independence of the parameter temperature, aquatic load, oxygen saturation, etc., and their effects on the ecosystem and the effects of turbidity and nutrient supply on production of algae and water weeds. Investigation and research work are being carried out in cooperation with the Federal Institute for Water Biology and Waste Water Research in Vienna, University institutes, and consultant engineers. Similar studies carried out under the auspices of international organizations are consulted. Austria participates in some of these projects and also delegates experts to working groups, etc. The exchange of results and of experience gained will help to find optimal solutions for future energy supply without destruction of the environment. (auth)

8298 JAPANESE FISHERIES AND NUCLEAR POWER GENERATION. At. Jap.; 18: No. 7, 12-26(Jul 1974).

It is extremely important for Japan that nuclear power development and the problems related to fishing industry be amicably adjusted, especially in respect of in-shore fishing. Most Japanese nuclear power projects including the nuclear powered ship Mutsu, Onagawa power plant, and the first reprocessing plant, are facing a variety of problems between fishermen and contractors involved in each stage of planning, construction, operation and expansion of facilities. The situation of Japanese fisheries, especially coastal, i.e., world's highest fish production, fish diet for Japanese, increasing fish breeding and fishing rights, is explained in much detail using a number of tables. When nuclear utilities negotiate for the location for a power plant in a coastal area, they must give first consideration to local fishermen's cooperatives. It should be noted that fishermen are very nervous about radioactivity. If fishermen are to have adequate knowledge by which to exercise proper judgment on the release of low level radioactivity, nuclear utilities need to make massive efforts. (JA)

8299 NUCLEAR STEELMAKING IN JAPAN. Miura, M. (Agency of Industrial Science and Technology, Tokyo Japan). Nenryo Kyokai-shi; 53: No. 570, 822-834(Oct 1974). (In Japanese).

The expected nuclear steelmaking pattern is shown. Based on the given condition that the temperature of reducing gas to be blown into the reduction furnace should be 800 to 850°C, efforts will be made so that a reactor-outlet helium temperature of 1000°C can be guaranteed in consideration of temperature drop in the heat exchanger. The heat taken out of the multi-purpose high-temperature reactor will be used through the intermediate heat exchanger for manufacturing and heating of reducing gas. In Japan, the reducing gas will be manufactured from vacuum residual oils because of the scarcity of petroleum and natural gases. A steelmaking system has been adopted in which the reduced iron produced by shaft furnaces is turned into crude steel by electric furnaces. With this pattern of nuclear steelmaking, the first-phase program extending over a period of six years will aim at the completion of research and development of major relevant components such as a high-temperature heat exchanger, heat-resistant superalloys, high-temperature heat insulation materials, reducing-gas manufacturing units and reduced iron manufacturing units as well as research for the development of a system design to link the reactor system with the steelmaking system with a high degree of consistency and safety. (auth)

8300 ENERGY PROBLEMS IN THE UNITED STATES AND NUCLEAR POWER. Stathakis, G. J. (Atomic Industrial Forum, Inc., New York (USA)). At. Jap.; 18: No. 4, Suppl., 41-47(Apr 1974).

From 7th annual conference of the Japan Atomic Industrial Forum; Tokyo, Japan (5 Mar 1974).

Why there is energy problem in the United States, and how nuclear power generation is being tackled in this connection, are reviewed. The principal cause of the energy crisis is in the lack of the institutional mechanisms capable of seeing the complex nature of the energy supply situation. In the meantime, the order for nuclear power generation is growing tremendously, and the outlook for nuclear industry is promising. It is advantageous over the conventional means of power generation, in such areas as lower fuel cost, petroleum saving, and less environmental pollution. The performance of nuclear power generation as compared with other types of power generation is bound to improvement in the future. In the United States, many steps are being taken to advance the role of nuclear power. (JA)

8301 NUCLEAR POWER, SAFETY AND ENVIRONMENT. Eklund, S. (International Atomic Energy Agency, Vienna (Austria)). At. Jap.; 18: No. 4, Suppl., 19-32(Apr 1974).

From 7th annual conference of the Japan Atomic Industrial Forum; Tokyo, Japan (5 Mar 1974).

The overall picture of nuclear energy situation in the world, the problems associated with this new energy source, and the measures to deal with them are reviewed under the three broad headings of nuclear power, safety, and environment. Large additional amounts of energy are needed to maintain the current quality of human life, and nuclear power through fission is ready to meet the requirement. The safety of nuclear power reactors is sufficient, and even more so in the future. In this regard, the role by IAEA is significant. Concerning radioactive wastes, they will be safely isolated from environment. Nuclear power provides a means of bridging energy gap until new sources of power are developed, and it has acceptable environmental consequences. (JA)

8302 THE SPECIFIC TASK OF NUCLEAR SAFETY WITHIN A GENERAL FRAMEWORK OF ENVIRONMENTAL PROTECTION. A Contribution from German Points of View. Franzen, L. F. (Reactor Safety Inst. (F. R. Germany)). At. Jap.; 18: No. 5, Suppl. 1, 10-23(May 1974).

The present state of development of nuclear plants, licensing and compliance procedures, and public acceptance are described. Further, the future goals for energy, safety philosophy, and site provision are explained. Finally, technical problems such as airplane crash, plant security, pressure vessel integrity, and emergency planning are studied. A total of 24 nuclear power plants in the Federal Republic of Germany with electrical capacity of approximately 15,000 MW have been either ordered or planned. The installed generating capacity in FRG amounted to a total of approximately 60,000 MW at the end of 1973, and it will probably increase to 140,000 MW in 1985. This requires the construction of approximately 100 large generating units. The 34,000 signatures against the construction of the nuclear power plant Grafenrheinfeld and 65,000 interveners against the nuclear power plant Breisach signalize the effectiveness of these groups in fighting nuclear energy. Nuclear energy critics are roughly subdivided into (1) conservative circles, (2) truly concerned, partially well organized citizens, and (3) radicals whose actions against nuclear energy are only example and pretense towards the change of the present system. Three principles must be followed in order to attain the extraordinarily high level of safety: (1) prevention of accidents through the careful design of all systems and components and the use of inherent safety features; (2) mitigation of accidents by providing engineered safeguards to the failure of individual systems and components; and (3) the additional provision to unlikely events such as earthquakes, floods, airplane crashes, etc. (JA)

8303 ANALYSIS OF CONDUCTION-CONTROLLED REWETTING OF A VERTICAL SURFACE. Tien, C. L.; Yao, L. S. (Univ. of California, Berkeley). J. Heat Transfer; 97: No. 2, 161-165(May 1975).

A two-dimensional analysis is presented of conduction-controlled rewetting of a vertical surface whose initial temperature is greater than the rewetting temperature. The physical model consists of an infinitely extended vertical slab with the surface of the dry region adiabatic and the surface of the wet region associated with a constant heat transfer coefficient. The physical problem is characterized by three parameters: the Peclet number or the dimensionless wetting velocity, the Biot number, and a dimensionless temperature. Limiting solutions for large and small Peclet numbers obtained by utilizing the Wiener–Hopf technique and the kernel-substitution method exhibit simple functional relationships among the three dimensionless parameters. A semi-empirical relation has been established for the whole range of Peclet numbers. The solution for large Peclet numbers possesses a functional form different from existing approximate two-dimensional solutions, while the solution for small Peclet numbers reduces to existing one-dimensional solution for small Biot numbers. Discussion of the present findings has been made with respect to previous analyses and experimental observations. (auth)

8304 NUCLEAR ENERGY CENTERS: A PRIME ELEMENT IN REACTOR SITING. Cope, D. F. (Federal Energy Administration, Washington, DC). Nucl. Saf.; 16: No. 3, 282-290(1975).

Meeting the nation's future energy requirements portends a major role for nuclear power. This could result in hundreds of relatively small, dispersed nuclear sites throughout the country by the year 2000 if present siting trends were to continue. The siting of several nuclear reactors and their associated facilities in a small number of concentrated nuclear energy centers is an alternative having many advantages. The background of the idea and some of the advantages and problems in clustering nuclear reactors into nuclear energy centers are discussed. It is concluded that there are compelling arguments for the national deployment of nuclear energy, particularly breeder reactors, into such centers, but there are many unresolved issues on which much work must be done before final answers are available as to the size, composition, and extent to which the energy-center concept can be applied. (auth)

8305 PIN-TO-PIN FAILURE PROPAGATION IN LIQUID-METAL-COOLED FAST BREEDER REACTOR FUEL SUBASSEMBLIES. van Erp, J. B. (Argonne National Lab., IL); Chawla, T. C.; Wilson, R. E.; Fauske, H. K. Nucl. Saf.; 16: No. 3, 291-307(1975).

It is concluded that (1) pin-to-pin fuel-failure propagation for current LMFBR designs is unlikely, and (2) if failure propagation occurs at all, it will be self-limiting or its progression will be slow, thus allowing ample time for detection and corrective action if appropriate instrument systems are provided. (98 references) (auth)

8306 BACK FLOW IN TURBINES OF NUCLEAR CLOSED-CYCLE GAS TURBINE PLANTS IN CASE OF CIRCUIT PIPE RUPTURE. Bammert, K.; Zehner, P. (Univ. of Hanover). J. Eng. Power; 97: No. 2, 189-194(Apr 1975).

From gas turbine conference; Zurich, Switzerland (31 Mar 1974).

For operation of a gas turbine in single-cycle arrangement with a high-temperature reactor, rupture of a main circuit pipe has to be included in the safety considerations. In the event of such an accident there may be a back flow through the turbo machines or a forward flow up to the choking limit. Tests carried out in a two-dimensional cascade wind tunnel on turbine cascades under back flow conditions are reported. By the example of three selected representative cascades; the characteristic features in turbine cascades with back flow are discussed. These cascades are a rotor blade tip section with aerofoil-like profiles and a wide pitch, a stator blade or rotor blade mean section with an usual deflection and a rotor blade root section with a narrow pitch and a large deflection. The loss coefficient with back flow is a multiple of the loss coefficient of a cascade with normal flow conditions. (Auth)

Reactor Theory and Calculation

Refer also to abstracts 7674, 8016–8018, 8032, and 8089.

8307 (CEA-N-1773) ELABORATION OF A SET OF A COHERENT NUCLEAR DATA FOR A THERMAL REACTOR CALCULATIONS: QUALIFICATION OF THE CODE APOLLO. Mikhail, M. L. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Div. d'Etude et de Developpement des Reacteurs). Dec 1974. 172p. (In French). Dep. NTIS (US Sales Only) $11.75.

Thesis. Submitted to Paris Univ., Orsay, France.

APOLLO, a multigroup code for the resolution of the transport equation for thermal and fast neutrons, is a tool which allows a very precise calculation of the neutron flux. However, it is essential that these calculations are tested by direct comparison with experimental results obtained for a wide range of lattices. The justification of the use of APOLLO is made in two steps: test of the reference library (UKAEA-1968) and search for the trends to modify it, the comparison with the other available libraries (ENDF/B (versions II and III) and UKAEA-73) in order to determine the one most suitable for calculational purposes. For the adjustment of the reference library, certain experimental results have been used. 38 references. (auth)

8308 (CONF-730611-19) IMPORTANCE FUNCTION FINE STRUCTURE AND THE CENTRAL WORTH DISCREPANCY. Greenspan, E. (Princeton Univ., N. J. (USA). Plasma Physics Lab.). 1972. Contract AT(11-1)-3073. 6p. Dep. NTIS $4.00.

From 19th annual meeting of the American Nuclear Society; Chicago, Illinois, USA (10 Jun 1973).

The effects of neglecting the fine structure if importance functions in reatcivity worth calculations are examined. It is concluded that the fine structure can contribute significantly to the calculated value of reactivity coefficients. (JWR)

8309 (CONF-750413-P1) PROCEEDINGS OF THE CONFERENCE ON COMPUTATIONAL METHODS IN NUCLEAR ENGINEERING, CHARLESTON, SOUTH CAROLINA, APRIL 15–17, 1975. Volume I. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.; Energy Research and Development Administration, Aiken, S. C. (USA). Savannah River Operations Office). 1975. 456p. Dep. NTIS $10.60.

Separate abstracts are included for each of the 23 papers presented concerning multidimensional static diffusion theory, reactor transient analysis, and applications of optimum control to reactor problems. (DCC)

For abstracts of individual papers see: 8016, 8017, 8032, 8089, 8213–8218, 8310–8315, 8368–8372, 8388, and 8389.

8310 (CONF-750413-P1, pp I.1-I.23) CURRENT TRENDS IN MULTIDIMENSIONAL STATIC REACTOR CALCULATIONS. Wagner, M. R. (Kraftwerk Union AG, Erlangen, Ger.). 1975.

From ANS computational methods in nuclear energy; Charleston, South Carolina, USA (15 Apr 1975).

In proceedings of the conference on computational methods in nuclear engineering. Vol. I. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.; Energy Research and Development Administration, Aiken, S. C. (USA). Savannah River Operations Office).

The more recent attempts to formulate alternatives to the classical finite difference method for solving large three-dimensional reactor problems are discussed in some detail. A number of higher order coarse mesh methods are described that allow the solving of global 3D-reactor problems accurately and efficiently on a routine basis. The present status of the finite element methods is then reviewed briefly. An attempt is made to evaluate the further potential of FEM for application to realistic multidimensional reactor problems. Results of numerical comparison studies are presented that show the promise of consistent nodal methods to give an optimal balance with respect to accuracy and efficiency. Special consideration is given also to new aspects that arise if coarse mesh methods are applied for practical reactor design calculations. It is shown that accurate predictions of local quantities may be obtained by solving detailed fine-mesh problems imbedded in a converged global solution. Finally, some more general aspects of multidimensional flux synthesis methods are discussed. Improvements may be expected by using more flexible schemes of trial function generation and applying overlapping multichannel synthesis methods. (65 references) (auth)

8311 (CONF-750413-P1, pp I.39-I.51) QUADRATIC FINITE ELEMENTS FOR X-Y AND R-Z GEOMETRIES. Walters, W. F. (Univ. of Delaware, Newark); Miller, G. D. 1975.

From ANS computational methods in nuclear energy; Charleston, South Carolina, USA (15 Apr 1975).

In proceedings of the conference on computational methods in nuclear engineering. Vol. I. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.; Energy Research and Development Administration, Aiken, S. C. (USA). Savannah River Operations Office).

The use of a quadratic finite element method is explored in both X-Y and R-Z geometries. It is observed that the method yields similar results in both geometries. The nonself-adjoint two-group diffusion equations are used, and reactor configurations containing singular points are examined. For "small" element size, it is verified that the error in the neutron multiplication constant, as a function of element size, is a two-term expression. The results of test problems indicate that high orders of convergence do not at all imply superior accuracy in the numerical solutions. (20 references) (auth)

8312 (CONF-750413-P1, pp I.53-I.69) EXPERIENCES WITH THE FINITE ELEMENT METHOD FOR STANDARD REACTOR CALCULATIONS. Schmidt, F. A. R. (Institut fuer Kernenergetik, Stuttgart); Ambrosius, H.; Franke, H. P.; Sapper, E.; Wagner, M. R. 1975.

From ANS computational methods in nuclear energy; Charleston, South Carolina, USA (15 Apr 1975).

In proceedings of the conference on computational methods in nuclear engineering. Vol. I. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.; Energy Research and Development Administration, Aiken, S. C. (USA). Savannah River Operations Office).

It has been demonstrated that the Finite Element Method (FEM) can be used to solve the multidimensional neutron diffusion equation both fast and accurately. The underlying theories are described. Starting from calculational experiences various conclusions are drawn for further developments of two and three dimensional FEM codes. (10 references) (auth)

8313 (CONF-750413-P1, pp I.117-I.165) DEVELOPMENT AND COMPARISON OF PRACTICAL DISCRETIZATION METHODS FOR THE NEUTRON DIFFUSION EQUATION OVER GENERAL QUADRILATERAL PARTITIONS. Abu-Shumays, I. K.; Hageman, L. A. (Bettis Atomic Power Lab., Pittsburgh). 1975.

From ANS computational methods in nuclear energy; Charleston, South Carolina, USA (15 Apr 1975).

In proceedings of the conference on computational methods in nuclear engineering. Vol. I. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.; Energy Research and Development Administration, Aiken, S. C. (USA). Savannah River Operations Office).

Several low-order finite element and finite difference discretizations for the multigroup diffusion equation over a quadrilateral mesh in the plane have been developed. Included are hybrid methods which reduce to higher-order discretizations for model problems with uniform mesh subdivisions. Each of these methods can be easily extended to three dimensions using a pseudo variational approach. Extensive numerical experimentations and comparisons are summarized and indicate that the low order methods for suitable triangulations are in general better than the low order finite difference and isoparametric bilinear finite element methods for quadrilaterals. (19 references) (auth)

8314 (CONF-750413-P1, pp II.17-II.26) TRANSIENT HYDRAULIC ANALYSIS FOR REACTOR CORES. Rowe, D. S.; Stewart, C. W. (Battelle Pacific Northwest Labs., Richland, WA). 1975.

From ANS computational methods in nuclear energy; Charleston, South Carolina, USA (15 Apr 1975).

In proceedings of the conference on computational methods in nuclear engineering. Vol. I. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.; Energy Research and Development Administration, Aiken, S. C. (USA). Savannah River Operations Office).

The pressure-velocity and vorticity-velocity methods developed for solutions of classical flow field equations can be used to solve lumped parameter control volume equations for core analysis. Both methods can be used to solve for the flow field with specified pressure boundary conditions. The pressure velocity method uses the pressure boundary-condition directly whereas the vorticity-velocity method uses the momentum integral technique to convert the pressure boundary condition to a flow boundary condition. "Donor-cell" differencing for convective terms allows the numerical solution of flow reversals and recirculations while maintaining transportive and conservative properties. Explicit time differences impose time step limitations to assure stability. (15 references) (auth)

8315 (CONF-750413-P1, pp II.71-II.84) FLICA III: A DIGITAL COMPUTER PROGRAM FOR THERMAL-HYDRAULIC ANALYSIS OF REACTORS AND EXPERIMENTAL LOOPS. Plas, R. (CEN de Saclay, Gif-sur-Yvette, France). 1975.

From ANS computational methods in nuclear energy; Charleston, South Carolina, USA (15 Apr 1975).

In proceedings of the conference on computational methods in nuclear engineering. Vol. I. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.; Energy Research and Development Administration, Aiken, S. C. (USA). Savannah River Operations Office).

This computer program describes the flow and heat transfer in steady and transient state in two-phase flows. It is the present stage of the evolution about FLICA, FLICA II and FLICA II B codes, which have been used and developed at CEA for the thermal-hydraulic analysis of reactors and experimental loops with heating rod bundles. In the mathematical model all the significant terms of the fundamental hydrodynamic equations are taken into account with the approximations of turbulent viscosity and conductivity. The two-phase flow is calculated by the homogeneous model with slip. The equations are solved with the finite difference discretization method by an iterative scheme at each level. This method does not allow solving the problem in which the pressure changes are very fast. In the flow direction an implicit resolution scheme is available, which makes possible the study of partial or total flow blockage, with upstream and downstream effects. All the iterative processes have been specially fitted for a fast convergence. A special model represents the helical wire effects in out-of-pile experimental rod bundles. (auth)

8316 (CONF-750413-P2) PROCEEDINGS OF THE CONFERENCE ON COMPUTATIONAL METHODS IN NUCLEAR ENGINEERING, CHARLESTON, SOUTH CAROLINA, APRIL 15-17, 1975. Volume II. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.; Energy Research and Development Administration, Aiken, S. C. (USA). Savannah River Operations Office). 1975. 540p. Dep. NTIS $10.60.

Separate abstracts are included for each of the 33 papers presented concerning radiation transport, mechanics, environmental and economic modeling of nuclear plants, code systems and software, multidimensional static reactor theory, computer code exchange, and multidimensional dynamics. (DCC)

For abstracts of individual papers see: 6231, 6337, 6434, 6435, 6789, 8018, 8033, 8103, 8317-8339, 8352, and 8381.

8317 (CONF-750413-P2, pp III.1-III.14) MONTE CARLO, FINITE ELEMENT AND S/sub N/ METHODS. Gelbard, E. M. (Argonne National Lab., IL). 1975.

From ANS computational methods in nuclear energy; Charleston, South Carolina, USA (15 Apr 1975).

In proceedings of the conference on computational methods in nuclear engineering. Vol. II. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.; Energy Re-

search and Development Administration, Aiken, S. C. (USA). Savannah River Operations Office).

The present capabilities and limitations of S/sub N/, Monte Carlo, and finite element transport computational methods are reviewed. Outstanding problems remaining in these computational methods are discussed. (29 references) (auth)

8318 (CONF-750413-P2, pp III.15-III.30) COLLISION PROBABILITIES AND RESPONSE MATRICES: AN OVERVIEW. Leonard, A. (Ames Research Center, Moffett Field, CA). 1975.

From ANS computational methods in nuclear energy; Charleston, South Carolina, USA (15 Apr 1975).

In proceedings of the conference on computational methods in nuclear engineering. Vol. II. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.; Energy Research and Development Administration, Aiken, S. C. (USA). Savannah River Operations Office).

Generally the term collision probability method is applied to a technique that employs a discretization of the integral form of the transport equation. Relative to the discrete ordinates method, the collision probability technique has the advantages of dealing with fewer number of variables (no angular coordinates) and generally faster convergence. Significant disadvantages include dense coupling of the variables, expensive precalculation of collision probabilities, and difficulties in treating anisotropic scattering. Various techniques for circumventing these weaknesses are described. In the response matrix method the assembly or system to be analyzed is decomposed into a number of simple subunits. The approximate Green's functions or response matrices of each type of subunit are then precalculated. To the desired accuracy, these response matrices yield the outgoing neutron currents to any given input. Thus the unknowns are the interface currents and the coefficient matrix contains all the response matrices. A wide variety of techniques can and have been used to generate response matrices--diffusion theory, S/sub n/ methods, Monte Carlo, collision probabilities, and even response matrices. Again the precalculations are expensive. On the other hand once a response matrix has been computed, it may be stored and used again. Thus response matrix methods appear to be particularly advantageous for burnup, optimization, and possibly many kinetics problems where the properties of many subunits do not change. (43 references) (auth)

8319 (CONF-750413-P2, pp III.31-III.47) STATIONARY FUNCTIONALS AND MONTE CARLO. Ragheb, M. M. H.; Maynard, C. W.; Conn, R. W. (Univ. of Wisconsin, Madison). 1975.

From ANS computational methods in nuclear energy; Charleston, South Carolina, USA (15 Apr 1975).

In proceedings of the conference on computational methods in nuclear engineering. Vol. II. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.; Energy Research and Development Administration, Aiken, S. C. (USA). Savannah River Operations Office).

Use of stationary functionals from variational theory in Monte Carlo computations for source problems is discussed. A set of minimum variance estimators based on the optimal linear combination of the terms constituting these functionals is suggested, particularly, a Modified Nakache--Kalos--Goldstein Method. However, first order cancellation of errors is not implied. A two-stage sequential procedure using these estimators is used. Relationship to previous work is discussed, and the results of numerical application to discrete random walks for estimation of inner products over linear systems are exposed. Satisfactory results are obtained from the proposed Modified Nakache--Kalos--Goldstein method. Better results are expected from the general method by application of stratified sampling. 19 references. (auth)

8320 (CONF-750413-P2, pp III.67-III.83) C/sub N/ METHOD IN CYLINDRICAL GEOMETRY AND ONE-VELOCITY THEORY. Kavenoky, A. (CEN de Saclay, Gif-sur-Yvette, France). 1975.

From ANS computational methods in nuclear energy; Charleston, South Carolina, USA (15 Apr 1975).

In proceedings of the conference on computational methods in nuclear engineering. Vol. II. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.; Energy Research and Development Administration, Aiken, S. C. (USA). Savannah River Operations Office).

The C/sub N/ method of solving the transport equation has been developed at Saclay during the last few years: its main advantage is that the computing time is independent of the size of the media considered. This method is based on a lemma proved by Placzek: an integral equation is provided for the angular flux at the boundaries of the media, its kernel is the infinite medium Green's function. The knowledge of the angular flux at the boundaries of the media allows the fluxes to be calculated at any point. The application to classical problems in one velocity cylindrical geometry is presented: albedo of the inner and outer problems, extrapolation length for the Milne problem, critical radius. 14 references. (auth)

8321 (CONF-750413-P2, pp III.85-III.100) ITERATIVE SOLUTION METHODS FOR TWO-DIMENSIONAL FINITE ELEMENT APPROXIMATIONS IN NEUTRON TRANSPORT. Yuan, Y. C.; Lewis, E. E.; Miller, W. F. Jr. (Northwestern Univ., Evanston, IL). 1975.

From ANS computational methods in nuclear energy; Charleston, South Carolina, USA (15 Apr 1975).

In proceedings of the conference on computational methods in nuclear engineering. Vol. II. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.; Energy Research and Development Administration, Aiken, S. C. (USA). Savannah River Operations Office).

Three iterative methods are applied to finite element discretizations of the one-group even-parity transport equation: point and block successive over-relaxation (SOR), and accelerated block SOR. Two memory allocation schemes are used. The first permits arbitrary triangulation of the spatial domain, while the second is restricted to rectangular grids. For fixed angular approximation, the coefficient matrix memory requirement for the first is proportional to the number of spatial mesh points, while that for the second is proportional to only the number of material regions. Comparison calculations indicate that block SOR is more efficient than either point SOR or the conjugate gradient method used previously. Benchmark results demonstrate that finite element transport methods have progressed to the point where problems with several thousand spatial nodes can be treated with computational efficiency approaching to well within an order of magnitude of that achieved with a highly developed discrete ordinate production code. 11 references. (auth)

8322 (CONF-750413-P2, pp III.101-III.125) DISCRETE ORDINATE-TO-SPHERICAL HARMONIC CONVERSIONS FOR RAY EFFECT MITIGATION IN X-Y GEOMETRY. Miller, W. F. Jr.; Reed, W. H. (Los Alamos Scientific Lab., NM). 1975.

From ANS computational methods in nuclear energy; Charleston, South Carolina, USA (15 Apr 1975).

In proceedings of the conference on computational methods in nuclear engineering. Vol. II. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.; Energy Research and Development Administration, Aiken, S. C. (USA). Savannah River Operations Office).

Several fictitious sources are considered that, when appended to the discrete ordinates equations, convert those equations to spherical harmonic or spherical-harmonic-like equations. The fictitious sources reported in the literature are cataloged using projection operator notation. A new source is presented that yields better computer running times for spherical harmonics solutions. The S_2 to P_1 source is discussed in detail, including vacuum and reflective boundary conditions. A simple algorithm for reducing the running times required to obtain spherical harmonic solutions is presented. This algorithm reduces the size of the fictitious source in groups where ray effect distortions are not expected. The new source and the algorithm for running time reduction make this approach viable for solving the ray effect problem. 13 references. (auth)

8323 (CONF-750413-P2, pp IV.1-IV.22) SEIDEL-TYPE ITERATION FOR SOLVING EQUILIBRIUM EQUATIONS OF MECHANICAL SYSTEMS. Melosh, R. J. (Marc Analysis Research Corp., Palo Alto, CA). 1975.

From ANS computational methods in nuclear energy; Charleston, South Carolina, USA (15 Apr 1975).

In proceedings of the conference on computational methods in nuclear engineering. Vol. II. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.; Energy Research and Development Administration, Aiken, S. C. (USA). Savannah River Operations Office).

The most widely accepted way of solving linear equilibrium equations is Gauss decomposition. Implementation of this approach is summarized. Improved Seidel-type iterative methods are examined as an alternative. Two classes of problems are defined: one involving extremely sparse and the other, fully-populated matrices. Self-equilibration, block relaxation, interwoven iteration, hybridization, and extrapolation for improving Seidel efficiency are described. The results of experiments show the effectiveness of each device alone and several combinations. The full potential of these devices is realized when only three cycles of iteration produce the exact solution regardless of the number of equations and the initial guess for the fully-populated. Orders of magnitude reduction are attained for the sparse matrices suggesting Seidel-type iteration can involve fewer calculations than Gauss when the wavefront is large compared with the matrix order. 13 references. (auth)

8324 (CONF-750413-P2, pp IV.55-IV.76) COMPUTATIONAL TECHNIQUES IN INCREMENTAL METHODS IN MECHANICS. Rashid, Y. R. (General Electric Co., San Jose, CA). 1975.

From ANS computational methods in nuclear energy; Charleston, South Carolina, USA (15 Apr 1975).

In proceedings of the conference on computational methods in nuclear engineering. Vol. II. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.; Energy Research and Development Administration, Aiken, S. C. (USA). Savannah River Operations Office).

A brief overview is presented of incremental methods in mechanics considering the total quasi-static thermo-mechanical problem. Formulation of the governing equations is given for the combined effects of finite deformation and inelastic responses. By separating the contributions of the various non-linear phenomena from the linear stiffness and force matrices, the computational characteristics of each are conveniently discussed. A particularly interesting result is the establishment of computable upper bounds for the size of the time step necessary for the convergence and stability of the various non-linear sub-problems, namely, the thermal problem, the elastic finite deformation problem, and the inelastic small deformation problem considering the so-called tangent stiffness and initial body force procedures. 12 references. (auth)

8325 (CONF-750413-P2, pp V.1–V.10) MODULAR PROGRAM SYSTEM KAPROS FOR EFFICIENT MANAGEMENT OF COMPLEX REACTOR CALCULATIONS. Bachmann, H.; Buckel, G.; Hoebel, W.; Kleinheins, S. (Gesellschaft fuer Kernforschung mbH, Karlsruhe, Ger.). 1975.

From ANS computational methods in nuclear energy; Charleston, South Carolina, USA (15 Apr 1975).

In proceedings of the conference on computational methods in nuclear engineering. Vol. II. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.; Energy Research and Development Administration, Aiken, S. C. (USA). Savannah River Operations Office).

At the Nuclear Research Center in Karlsruhe the modular program system KAPROS (Karlsruher Programmsystem) is now available for reactor calculations. The contents of KAPROS, the modules, will be extended systematically during the next years. KAPROS shares with many well-known modular program systems some general aims: modular and open ended design; automatic data management; and central data base. 4 references. (auth)

8326 (CONF-750413-P2, pp V.11–V.25) HIREINS: HITACHI REACTOR INFORMATION SYSTEM. Ohnishi, T. (Hitachi Ltd., Kanagawa, Japan); Watanabe, T.; Urushihara, H.; Matsuoka, K. 1975.

From ANS computational methods in nuclear energy; Charleston, South Carolina, USA (15 Apr 1975).

In proceedings of the conference on computational methods in nuclear engineering. Vol. II. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.; Energy Research and Development Administration, Aiken, S. C. (USA). Savannah River Operations Office).

Hitachi Reactor Information System HIREINS controls reactor design computations and manages computed results and other design information stored in a data base. It is intended to be not only a modular computation system but a design information system. Features and operating methods of HIREINS are described. (auth)

8327 (CONF-750413-P2, pp V.43–V.56) IANUS: A REACTOR CODE SYSTEM FOR NUCLEAR DESIGN CALCULATIONS. Gebhardt, W.; Luigs, D. (INTERATOM, Bensberg, Ger.). 1975.

From ANS computational methods in nuclear energy; Charleston, South Carolina, USA (15 Apr 1975).

In proceedings of the conference on computational methods in nuclear engineering. Vol. II. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.; Energy Research and Development Administration, Aiken, S. C. (USA). Savannah River Operations Office).

A survey is given for the modular code system IANUS. Basic features and the present computational capabilities are briefly described. The special data management in IANUS facilitates access to individual data elements in the data base. Control and principal operation of this data transfer in IANUS and the way of module sequence control are explained. (auth)

8328 (CONF-750413-P2, pp V.57–V.67) MULTIDIMENSIONAL APPLICATIONS OF AN INTEGRAL BALANCE TECHNIQUE FOR NEUTRON DIFFUSION COMPUTATIONS. Burns, T. J.; Dorning, J. J. (Univ. of Illinois, Urbana). 1975.

From ANS computational methods in nuclear energy; Charleston, South Carolina, USA (15 Apr 1975).

In proceedings of the conference on computational methods in nuclear engineering. Vol. II. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.; Energy Research and Development Administration, Aiken, S. C. (USA). Savannah River Operations Office).

An integral balance technique is developed and applied to the solution of one-, and two-dimensional neutron diffusion problems. The technique involves approximating a local integral form of the diffusion equation, and the use of partial current continuity conditions at volume element interfaces. Calculations for a series of test problems are presented. The results are compared to those obtained using the finite difference and finite element methods. The integral balance technique, referred to as the partial current balance (PCB) method, yields a significant increase in the accuracy attainable relative to the comparison techniques for a given spatial partition. Moreover, the proposed partial current balance method is shown to be a more efficient solution scheme for the test problems considered. 10 references. (auth)

8329 (CONF-750413-P2, pp V.69–V.79) COARSE NODAL METHOD BASED ON HOMOGENEOUS MEDIUM DIFFUSION KERNELS. Steinke, R. G. (General Atomic Co., San Diego, CA). 1975.

From ANS computational methods in nuclear energy; Charleston, South Carolina, USA (15 Apr 1975).

In proceedings of the conference on computational methods in nuclear engineering. Vol. II. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.; Energy Research and Development Administration, Aiken, S. C. (USA). Savannah River Operations Office).

A new method is proposed for solving the inhomogeneous neutron diffusion equation in its Green's function integral form. The difficulty in approximating multidimensional diffusion kernels for heterogeneous systems is circumvented by assigning the effect of composition heterogeneity to the source in an iterative manner. Diffusion kernels for the region of solution, which is now of uniform composition, can be precalculated for any geometry and parameterized as a function of node size. A linear source shape approximation is used to improve the accuracy of the method. Negative image source transfer is performed in order to realize a logarithmic boundary condition. An acceleration procedure is described which generally provides convergence in one iteration when applied within the power iterative solution of the eigenvalue problem. A numerical study is reported to illustrate the accuracy and utility of the method for analyzing large reactor systems. 9 references. (auth)

8330 (CONF-750413-P2, pp V.81–V.94) GREEN'S FUNCTION AND INTERFACE CURRENT TECHNIQUE. Havranek, M. (Univ., Stuttgart). 1975.

From ANS computational methods in nuclear energy; Charleston, South Carolina, USA (15 Apr 1975).

In proceedings of the conference on computational methods in nuclear engineering. Vol. II. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.; Energy Research and Development Administration, Aiken, S. C. (USA). Savannah River Operations Office).

The Green's function for three dimensional diffusion operator defined in a subspace of functions satisfying homogeneous boundary conditions for incoming currents is determined. With the so constructed Green's function as a kernel of an integral operator, the fluxes and outgoing currents for any node are related to the incoming currents and distributed sources. These multigroup relations represent a set of integral equations for fluxes, escape and interface currents. The system is discretized by expanding the fluxes and currents in the same basis as used to construct the Green's function. Due to the orthonormality of the basis and use of proper representation for the Green's function, the equations for 3D Fourier coefficients of the fluxes and currents involve no more than one simple series. Standard source-iteration technique with normalized power iteration in the inner iteration together with the fission-source overrelaxation in outer iteration was used to solve the equations for the first mode. The results for rectangular parallelepipeds with a side-lengths of 10–10–20 cm are compared with that obtained from the first-collision probability method. 5 references. (auth)

8331 (CONF-750413-P2, pp V.95–V.109) INTEGRAL NEUTRON TRANSPORT THEORY, SLOWING-DOWN THEORY FOR ABSORBER LUMP IN AN ISOTROPIC NEUTRON BATH. Tai, D. (Univ. of Auckland, New Zealand); Underhill, G. K. 1975.

From ANS computational methods in nuclear energy; Charleston, South Carolina, USA (15 Apr 1975).

In proceedings of the conference on computational methods in nuclear engineering. Vol. II. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.; Energy Research and Development Administration, Aiken, S. C. (USA). Savannah River Operations Office).

The Boltzmann integrodifferential neutron transport equation has been converted to an integral equation which incorporates the isotropic neutron bath boundary condition. The resulting integral equation is solved using the discrete ordinates method, resulting in solutions for the spatially-dependent and -independent fluxes in terms of transport probabilities and the neutron emission density. The transport probabilities and the lethargy-dependence solution

are evaluated using a normalization condition and a neutron conservation equation, respectively, to correct for inherent error propagation. The formalism is applied to the calculation of uranium resonance integrals for a spherical, two-region lump consisting of a spherical absorber surrounded by a spherical cadmium cover. Calculated and experimental results for uranium-235 fission and uranium-238 capture resonance integrals compare favorably. 11 references. (auth)

8332 (CONF-750413-P2, pp V.111–V.134) TWO-DIMENSIONAL FEW GROUP RESPONSE MATRIX CALCULATION METHOD FOR FLUX AND REACTIVITY. McDaniel, C. T. (General Electric Co., San Jose, CA). 1975.

From ANS computational methods in nuclear energy; Charleston, South Carolina, USA (15 Apr 1975).

In proceedings of the conference on computational methods in nuclear engineering. Vol. II. (Du Pont de Nemours (E.I.) and Co., Aiken, S. C. (USA). Savannah River Lab.; Energy Research and Development Administration, Aiken, S. C. (USA). Savannah River Operations Office).

An efficient method is described for calculating flux and reactivity in two dimensional reactor lattices based upon application of energy and space dependent response matrices. These response matrices couple the group currents entering and leaving specified regions within the reactor lattice. These regions consist of rectangular fuel-clad-water pin cells and a ring-like structure of channel and water gap. Three novel features of this method consist of techniques for calculating the response matrices and which contribute to its speed and accuracy. These are: few group integral transport using collision probabilities for precalculation of the gap ring responses; few group homogeneous Monte Carlo method for the precalculation of water response functions of the pin cells for the four sectors of fuel and clad; and few group integral transport using successive generations to compute fuel response matrices. Converged exiting group currents are obtained using the successive over-relaxation method. Eigenvalue iterations re-estimate the fission source term from the computed fuel flux, which is obtained from absorption reaction rates based upon current balance. A comparison of calculated versus experimental results is presented. 8 references. (auth)

8333 (CONF-750413-P2, pp VI.1–VI.8) RRD PLANNING AND PROCEDURES RELATING TO COMPUTER CODING AND CODE INTERCHANGE. Neuhold, R. J.; Lewellen, J. W. (Div. of Reactor Research and Development, Washington, DC). 1975.

From ANS computational methods in nuclear energy; Charleston, South Carolina, USA (15 Apr 1975).

In proceedings of the conference on computational methods in nuclear engineering. Vol. II. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.; Energy Research and Development Administration, Aiken, S. C. (USA). Savannah River Operations Office).

Past and current coordinating procedures related to computer coding are reviewed and assessed with respect to their general applicability in the Civilian Reactor Program. Elements of closely coordinated activities specialized to a single discipline such as reactor physics which could have general utility are identified. 11 references. (auth)

8334 (CONF-750413-P2, pp VI.9–VI.25) ANS-10 ACTIVITIES RELATING TO COMPUTER PROGRAM PORTABILITY AND INTERCHANGE. Olhoeft, J. E. (Westinghouse Electric Corp., Pittsburgh). 1975.

From ANS computational methods in nuclear energy; Charleston, South Carolina, USA (15 Apr 1975).

In proceedings of the conference on computational methods in nuclear engineering. Vol. II. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.; Energy Research and Development Administration, Aiken, S. C. (USA). Savannah River Operations Office).

The Mathematics and Computations Division of the American Nuclear Society sponsors a standards committee which is designated as the ANS-10 Subcommittee. ANS-10 was formed to develop voluntary guidelines and practices that can serve the Division members and associates. The portability and interchange of computer programs have been an important consideration in this committee's efforts. A summary of past and current activities of ANS-10 is presented. In addition a brief description of the ANSI organization and procedures for standards development is included for background information. 6 references. (auth)

8335 (CONF-750413-P2, pp VI.27–VI.37) NETWORKS: A MEDIUM FOR SHARING. Butler, M. K. (Argonne National Lab., IL). 1975.

From ANS computational methods in nuclear energy; Charleston, South Carolina, USA (15 Apr 1975).

In proceedings of the conference on computational methods in nuclear engineering. Vol. II. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.; Energy Research and Development Administration, Aiken, S. C. (USA). Savannah River Operations Office).

A brief survey is presented of the characteristics of some operational, research and commercial computer networks and describes representative computer- and information-network facilities in use within the ERDA community. With this background the role and potential uses of the emerging computer-network technology are explored in the context of the Argonne Code Center program. 12 references. (auth)

8336 (CONF-750413-P2, pp VI.39–VI.48) AMERICAN NATIONAL STANDARDS INSTITUTE'S FORTRAN STANDARD: EFFECT UPON COMPUTER PROGRAM EXCHANGE. Marshall, N. H. (Aerojet Nuclear Co., Idaho Falls, ID). 1975.

From ANS computational methods in nuclear energy; Charleston, South Carolina, USA (15 Apr 1975).

In proceedings of the conference on computational methods in nuclear engineering. Vol. II. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab., Energy Research and Development Administration, Aiken, S. C. (USA). Savannah River Operations Office).

Most implementations of the Fortran computer language in use today are based upon two 1966 standards published by the American National Standards Institute. These standards have done much to minimize the problems of computer program portability, but they are no longer current. Fortran language needs have been progressed beyond the 1966 standards. The American National Standards Institute's X3J3 committee worked for several years to extend and update the 1966 standards. Their work should reestablish the value of the Fortran standard as a guide to the implementation and use of Fortran. The up-to-date guidelines provided by the proposed new Fortran standard should help minimize the problems of program interchange and program portability. Several of the extensions to Fortran included in the X3J3 proposed standard are discussed. Included are the addition of character data type, extensions to the DO loop, and extensions to Fortran input/output. (auth)

8337 (CONF-750413-P2, pp VI.49–VI.67) MULTIDIMENSIONAL REACTOR DYNAMICS TODAY: AN OVERVIEW. Ferguson, D. R. (Argonne National Lab., IL). 1975.

From ANS computational methods in nuclear energy; Charleston, South Carolina, USA (15 Apr 1975).

In Proceedings of the conference on computational methods in nuclear engineering. Vol. II. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.; Energy Research and Development Administration, Aiken, S. C. (USA). Savannah River Operations Office).

The current status of the field of computational methods and computer codes for the analysis of reactor transients in two and three dimensions is reviewed. Several reasons for the current heightened interest in multidimensional reactor transient analysis are first presented. Computational methods which have been developed for multidimensional analyses are divided into four classes, and recent progress in the development and improvement of methods in each of these classes is discussed. A report on the status of several specific production-oriented code development efforts and code applications completes the paper. 38 references. (auth)

8338 (CONF-750413-P2, pp VI.85–VI.102) TIME-DEPENDENT COLLISION PROBABILITY METHOD FOR ANALYZING TRANSIENT NEUTRON BEHAVIOR. Lefvert, T. (Research Inst. of National Defense, Stockholm). 1975.

From ANS computational methods in nuclear energy; Charleston, South Carolina, USA (15 Apr 1975).

In proceedings of the conference on computational methods in nuclear engineering. Vol. II. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.; Energy Research and Development Administration, Aiken, S. C. (USA). Savannah River Operations Office).

An approximate method for the solution of the pulsed neutron problem is described. Using mean collision times, defined through collision probability weighting, the time variation of successively collided fluxes in a pulsed system is developed and added into a total flux. The method is tested against both time-dependent S/sub n/ and Monte Carlo calculations and also used to analyze a fast neutron pulsed experiment. 15 references. (auth)

8339 (CONF-750413-P2, pp VI.103–VI.122) TRASCAL: A TWO-DIMENSIONAL, MULTIGROUP, RESPONSE MATRIX KINETICS CODE. Sicilian, J. M.; Pryor, R. J. (E. I. du Pont de Nemours and Co., Aiken, SC). 1975.

From ANS computational methods in nuclear energy; Charleston, South Carolina, USA (15 Apr 1975).

In proceedings of the conference on computational methods in nuclear engineering. Vol. II. (Du Pont de Nemours (E. I.)

and Co., Aiken, S. C. (USA). Savannah River Lab.; Energy Research and Development Administration, Aiken, S. C. (USA). Savannah River Operations Office).

A new two-dimensional kinetics code in hexagonal geometry has been developed that utilizes the response matrix approach to neutron transport theory. Based on the static code RASCAL, TRASCAL incorporates an explicit treatment of delayed neutron precursors. This permits the approximation of transient response matrices in terms of the more readily calculated static matrices, a major computational advantage. TRASCAL has been coded to permit the use of multiple spatial and angular modes, which have been found useful in RASCAL. The response of reactors to abrupt changes in nu SIGMA/sub f/ at t equals 0 has been analyzed by both TRASCAL and the diffusion theory code TRIMHX. Both analyses agree very well for problems in which transport effects are insignificant. Where transport effects are important, the results differ accordingly. 10 references. (auth)

8340 (CONF-750607-4) POWER SPECTRAL DENSITY MEASUREMENTS WITH ^{252}Cf FOR A MOCK-UP OF THE FFTF. Mihalczo, J. T.; Pare, V. K.; Mathis, M. V. (Oak Ridge National Lab., Tenn. (USA)). 1974. 6p. Dep. NTIS $4.00.

From American Nuclear Society meeting; New Orleans, Louisiana, USA (8 Jun 1975).

A method of reactivity determination using noise correlation with ^{252}Cf source neutrons was tested in an experiment with the engineering mock-up core for the FFTF at the ZPR-9 facility. The results indicate that the method has potential use, particularly in the initial startup of LMFBR type reactors. (auth)

8341 (EURFNR-1236) STUDIES OF NEUTRONIC COUPLING BY REACTOR NOISE ANALYSIS IN TIME DOMAIN FOR FACILITIES OF RCN, PETTEN. Turkcan, E.; Dragt, J. B. (Stichting Reactor Centrum Nederland, Petten). Sep 1974. 40p. (CONF-741065-45; RCN-218). Dep. NTIS (US Sales Only) $5.00.

From EACRP specialist meeting on reactor noise from critical facilities to power plants; Rome, Italy (21 Oct 1974).

Work performed under United States–Euratom Fast Reactor Exchange Program.

After a review of existing literature on determination of neutronic coupling from reactor noise, a survey is presented of the work on this subject done from 1966 at RCN, Petten, using noise analysis in the time domain. A summary is given of the formulas used for the analysis of the noise. In particular a matrix inversion method is described, by which a matrix of kinetic parameters ("reactor matrix") and decay constants of the prompt modes can be found from the set of correlation functions. The experimental set-ups are described. Signals from ionisation chambers and from neutron counters have been processed with digital computers. Auto- and cross-correlation functions were determined by direct calculation or by a multi-detector Rossi-α algorithm. Coupling measurements have been performed in the LFR with two-slab core and annular core, in the STEK-Argonaut with two or four coupled thermal cores, and with the various fast-thermal coupled systems STEK-4000, –3000, –2000, and –1000 with a detector in each zone. Experimental results are shown, namely an early determination of coupling reactivity for two weakly coupled cores, the application of the matrix inversion method for various thermal cores, and the attempts to determine the reactor matrix in fast-thermal cores. 40 references. (auth)

8342 (FEI-365) SOME APPLICATIONS OF THE INTEGRAL PARAMETERS OF PERTURBATION THEORY IN REACTOR RESEARCH. Levin, V. E.; Pupko, V. Ya. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1974. 20p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

Features of reactor loading are analyzed as a function of active zone volume at a constant composition of reflector. Calculational relationships are derived, and a physical interpretation of power functions in these relationships is given. Formulas are obtained for temperature effects caused by thermal expansion of the reactor. The results of the calculations and the experiments are illustrated. (tr-auth)

8343 (HEDL-TME-75-26) USER'S MANUAL FOR COMPUTER CODE RIBD-II, A FISSION PRODUCT INVENTORY CODE. Marr, D. R. (Hanford Engineering Development Lab., Richland, Wash. (USA)). Jan 1975. Contract AT(45-1)-2170. 23p. Dep. NTIS $4.00.

The computer code RIBD-II is used to calculate inventories, activities, decay powers, and energy releases for the fission products generated in a fuel irradiation. Changes from the earlier RIBD code are: the expansion to include up to 850 fission product isotopes, input in the user-oriented NAMELIST format, and run-time choice of fuels from an extensively enlarged library of nuclear data. The library that is included in the code package contains yield data for 818 fission product isotopes for each of fourteen different fissionable isotopes, together with fission product transmutation cross sections for fast and thermal systems. Calculational algorithms are little changed from those in RIBD. (auth)

8344 (JAERI-M-5886) TWO-DIMENSIONAL MULTIGROUP DIFFUSION BURNUP CODE APOLLO FOR FAST REACTOR LONG-TERM BURNUP ANALYSIS. Ikawa, K. (Japan Atomic Energy Research Inst., Tokyo). Oct 1974. 52p. (In Japanese). INIS.

Apollo is a two-dimensional multigroup diffusion burnup code for the long-term burnup analysis of a fast reactor. Features of the code are as follows: Firstly the depletion equations can be solved independently for each composition in an annular region in R–Z geometry. It is thus possible to trace the change in characteristics of the individual fuel assembly with burnup. Secondly, it gives much of the information desired from design engineering. Reviewing the results of calculation is thus possible, reducing considerably the work required in long-term burnup analysis. Finally, the coarse-mesh calculation provides information of the initial flux. It reduces greatly the computer time for diffusion calculation especially of the multigroup calculation. The code is linked to three reactor constant sets, i.e., JAERI-FAST, ABBN and RCBN, each composed of infinitely dilute cross sections and self-shielding tables. Programming is in FORTRAN IV: prepared for FACOM 230/60, the code requires nine peripheral storage units. (auth)

8345 (JUL-1147-RG) TREATMENT OF ANISOTROPIC NEUTRON SCATTERING IN NUMERICAL REACTOR PHYSICS. Brockmann, H. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Reaktorentwicklung). Dec 1974. 62p. Dep. NTIS (US Sales Only) $6.25.

In many problems of reactor physics anisotropic scattering of neutrons in the high energy range has an important influence on the neutron transport through matter. To take this fact into account in neutronic calculations computer codes based on the Monte Carlo method and on the method of discrete ordinates are used. The different techniques for the handling of anisotropic scattering in the transport codes are described and discussed. For a comparison of the different methods the neutron flux distribution in a simple assembly consisting of natural lithium is investigated by three computer codes: a modified version of the Monte Carlo code ESP, the discrete ordinates transport code ANISN, and the multigroup Monte Carlo code MORSE which uses the same group cross sections as ANISN. In general, the agreement between the different codes is good; even better than one would expect from the approximations made in the codes ANISN and MORSE. Some discrepancies occur at the inner and outer boundary of the assembly; but it cannot be concluded that these are due to an incorrect handling of anisotropic scattering in some of the codes. (auth)

8346 (KFK-1274/3, pp vp) REACTOR THEORY. Krieg, B. Dec 1974. (In German).

1 fig.

In 3rd quarter annual report 1974. (Kernforschungszentrum Karlsruhe (F. R. Germany). Projekt Schneller Brueter).

New evaluations of the cross-sections of ^{238}U and ^{239}Pu for the KEDAK-3 nuclear data file have resulted in a number of changes relative to the values used so far. The influence of the lattice choice was studied to optimize the accuracy of two-dimensional diffusion calculations at a given computation expense. It was found to be small with respect to k_{eff} and large with respect to the flux and power density, especially at points of pronounced buckling. (auth)

8347 (ORNL-TM-4750) FABGEN, A TRANSIENT POWER-GENERATION AND ISOTOPE BIRTH RATE CALCULATOR. Roland, H. C. (Oak Ridge National Lab., Tenn. (USA)). Apr 1975. Contract W-7405-eng-26. 35p. Dep. NTIS $4.00.

A description is given of the FABGEN program, a fast-running program for calculating fuel element power-generation rates and selected fission product birth rates in a known neutron flux as functions of time. A first forward difference calculation is used, and the time step is one day. Provisions are made for including various fuel element lengths, variation of thermal flux with time, and use of different fertile isotopes. Five different fission products may be specified for birth-rate calculations. A daily summary may be output, or totals by days may be accumulated for final output. (auth)

8348 (ORNL-TM-4869) USERS MANUAL FOR TDT (TIME-DEPENDENT TASK). Tomlinson, E. T.; Dodds, H. L.; Lillie, R. A.; Robinson, J. C. (Oak Ridge National Lab., Tenn. (USA)). Jun 1975. Contract W-7405-eng-26. 61p. Dep. NTIS $6.25.

TDT is written in FORTRAN-IV, using flexible dimensioning, and is designed for computers in the IBM-360 series. TDT solves the one-dimensional multigroup form of the time-dependent reactor kinetics equations, allowing an arbitrary number of delayed neutron groups. The program can also solve standard static problems, such as eigenvalue problems (transport only), distributed source problems, and boundary source problems using either diffusion theory or transport theory. Convergence problems associated with highly multiplicative media are circumvented, and such problems are readily calculable. TDT employs a combination scattering and transfer matrix method to solve the transport equation in the spatial domain and a predictor-corrector method to obtain solutions in the temporal domain. The principal restrictions are available storage and computational time. Since the code is flexibly dimensioned, there are no internal restrictions on group structure, quadrature, and number of coordinates. The code contains an option whereby it will calculate the most efficient time mesh. The cylindrical geometry option is not operational in this version. A 10-second rod-drop transient in a 7-region, 5-group, S_4 problem requires 5 minutes on the IBM-360/91. A point kinetics approximation is available which significantly reduces the computational time. This version of TDT requires 178K of storage plus data block storage to execute on the IBM-360/91. One tape is required to utilize the flux tape option. (auth)

8349 CHAPMAN-KOLMOGOROV EQUATIONS FOR NEUTRON POPULATION IN A MULTIPLYING ASSEMBLY. Bellemi-Morante, A. (Univ., Bari, Italy). J. Math. Phys. (N. Y.); 16: No. 3, 585-589(Mar 1975).

It is proven that the Chapman–Kolmogorov system for neutron population in a multiplying assembly admits a unique positive and norm invariant solution belonging to the Banach space of summable sequences. It is then shown that the standard kinetic equation can be deduced in a rigorous way from such a system of a countably infinite number of partial differential equations. Finally, it is indicated how the Chapman–Kolmogorov initial-value problem can be approximated by a problem in a finite-dimensional space. (auth)

8350 METODY RASCHETA POLEI TEPLOVYKH NEITRONOV V RESHETKAKH REAKTOROV. (Methods of Calculating Thermal Neutron Fields in Reactor Lattices). Sheveleva, Ya. V. (ed.). Moscow; Atomizdat (1974). 312p.

On planning and designing a nuclear reactor it is important to have a correct idea of the accuracy of the calculational methods and of the reliability of the mathematical models which are used. A more realistic idea can be obtained by comparing the working models with a standard model. The book deals with the development of methods of calculating scattering, and methods of solving the many-group kinetic Boltzman equations on whose base programs can be created (or have already been created) that are almost standard programs. An estimate is given of the accuracy of a number of approximation methods used in reactor calculations. Analytical estimates are presented on the sensitivity of a number of reactor parameters to neutron interaction with reactor materials. (50 tables, 52 refs.) (SJR)

Reactor Components and Accessories

Refer also to abstracts 7049 and 8225.

8351 (CEA-CONF-2804) SAFETY INSTRUMENTATION IN NUCLEAR POWER PLANTS. Furet, J. (CEA Centre d'Etudes Nucleaires de Saclay, 91 – Gif-sur-Yvette (France). Services d'Electronique). 10 Jun 1974. 21p. (In French). INIS.

From international meeting on modern electrical power stations; Liege, Belgium (14 Oct 1974).

Only the safety equipment in the nuclear boiler control system is dealt with here. This equipment covers two categories of transducers which serve respectively for nuclear measurements (neutron flux) and thermodynamic measurements (temperature, pressure, flow rate, level). At low power, up to about one hundredth the nominal value, neutronic equipment is foremost in safety control while at power (above a few hundredths nominal) the thermodynamic equipment becomes essential. The development studies mainly concerned neutronic instruments. It is emphasized that the reliability factor must be associated with redundancy which allows "credibility" tests to be carried out in operation and ease of maintenance. It is shown that redundancy of test devices must be limited for the sake of economy and efficiency while safety and availability gains can be expected rather from improvements in their installation and use. (FR)

8352 (CONF-750413-P2, pp III,49-III,65) NEW TECHNIQUE FOR EVALUATING DIRECTION DEPENDENT FLUXES NEAR POWER REACTOR PRESSURE VESSELS. Almenas, K. (Univ. of Maryland, College Park); DeGangi, N.; Hopkins, W.; Dexheimer, D. 1975.

From ANS computational methods in nuclear energy; Charleston, South Carolina, USA (15 Apr 1975).

In proceedings of the conference on computational methods in nuclear engineering. Vol. II. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA), Savannah River Lab.; Energy Research and Development Administration, Aiken, S. C. (USA). Savannah River Operations Office).

A new technique for numerical integration over concentric cylindrical source surfaces has been developed. Applied to radiation transport, the method yields total as well as directionally dependent detector particle fluxes. The convergence properties of the method are analyzed and it is applied to an evaluation of neutron fluxes in the pressure vessel-- primary shield gap of a generic power reactor. Comparisons with alternate calculational techniques are presented. 9 references. (auth)

8353 (JAERI-M-5899) DEVELOPMENT OF AN INSTRUMENTED ALUMINUM OUTER TUBE-CAPSULE. Takeshita, I.; Seki, S.; Inoue, T. (Japan Atomic Energy Research Inst., Tokyo). Nov 1974. 39p. (In Japanese). INIS.

The aluminum outer tube-capsule is excellent in heat transfer, inexpensive, and safe for disposal after irradiation compared with the stainless steel one. Characteristics of the joined elements of both aluminum and stainless steel have been studied for the design of an instrumented aluminum outer tube-capsule. An aluminum outer tube-capsule with the element was constructed and irradiated successfully in JMTR for about two months at 50 MW. The test results of the element and irradiation of the capsule are described. (auth)

8354 (ORNL-SUB-3131-9) ELASTIC STRESSES AT REINFORCED NOZZLES IN SPHERICAL SHELLS WITH PRESSURE AND MOMENT LOADING. Phase Report 117-9. Rodabaugh, E. C.; Gwaltney, R. C. (Battelle Columbus Labs., Ohio (USA)). 28 Apr 1975. 91p. Dep. NTIS $7.75.

For Oak Ridge National Lab.

The ASME Boiler and Pressure Vessel Code gives design guidance for nozzles in pressure vessels in the form of "stress indices." These stress indices enable the designer of Class 1 nuclear pressure vessels to quickly determine the magnitude of stresses due to internal pressure loading; a task otherwise requiring an expensive and time-consuming stress analysis. The Code gives stress indices for nozzles in both heads and cylindrical vessels. Results of calculations of stresses in spherical heads or vessels are summarized. The validity of the Code indices for this geometry is examined and, as a result, a few relatively minor changes are recommended. The definitions involved in the use of the Code stress indices are not sufficiently clear and explicit. Accordingly, recommendations for changes in the Code to improve these definitions as well as to correct some obvious errors are presented. These recommendations apply to nozzles in cylindrical vessels and any type of formed head (e.g., spherical, elliptical, torispherical). However, the data presented herein apply only to isolated nozzles in spherical heads or in other heads where the radius of curvature in the vicinity of the nozzle in sphere-like, e.g., as in the center of a torispherical head. (auth)

8355 (ORNL-tr-2916) EXPERIMENTAL AND ANALYTICAL CAPACITY STUDY OF A PRESTRESSED CONCRETE STRUCTURE UNDER HARD STRESS. Fluge, F.; Gausel, E.; Lenschow, R. Translated from Nord. Betong; No. 5, 1-9(1973). 17p. Dep. NTIS $4.00.

Behavior in the inelastic range to rupture on four pneumatically loaded model vessels forms the basic for this paper. The geometry of the models is scaled 1:12 to a 800 MW(e) prototype projected by a Scandinavian team. A calculation of the cylindrical wall using a kinematic chain having several links was performed. Calculations of the pressure deformation relation for the plastic range up to failure are presented. Diagrams of total deflections up to failure (max. deflection about 75 times the deflection at design pressure) are presented together with corresponding strains measured on liner and bonded reinforcement, and are compared with computed values. Possible modes of rupture are discussed on the basis of the present investigations. (auth)

8356 COMBINED DRY/WET-COOLING TOWERS: THEIR ENVIRONMENTAL PROMISE AND THEIR PROBLEMS. Bogh, P.; Bhargava, N. (Motor-Columbus Consulting Engineers Inc., Baden, Switzerland). pp 45-62 of Environmental Effects of Cooling Systems at Nuclear Power Plants. Vienna; International Atomic Energy Agency (Feb 1975).

From symposium on the physical and biological effects on the environment of cooling systems and thermal discharges at nuclear

power stations; Oslo, Norway (26 Aug 1974). See STI/PUB-378; CONF-740820-.

The advanced technology of natural-draught cooling towers has led to their adoption for cooling most of the thermal power plants in Europe. Some impacts, such as the shadowing effect of the visible plume and the water consumption caused by the evaporation losses of the towers, are controversial matters at several sites. Also, the cumulative effect of the humidity release of the several large new plants, located not far from one another, may lead to problems due to increased cloud formation. The dry-cooling tower does solve the problem of the visible plume but the impact on the landscape owing to the tower's large dimensions cannot be ignored. Also, reduction of plant efficiency will lead to a greater consumption of natural energy resources. Some ideas of combining wet and dry towers are presented. The preliminary results of calculations with the program SAMOA for a 900-MW(e) nuclear power plant with different cooling systems are discussed. The study has shown that the superheating of the plume at tower outlet is a necessary but not sufficient condition for plume reduction. (auth)

8357 ATMOSPHERIC DISPERSION OF COOLING-TOWER BLOWDOWN. Schrecker, G. O.; Williams, S. L.; Shofner, F. M. (Environmental Systems Corp., Knoxville, TN). pp 63-74 of Environmental Effects of Cooling Systems at Nuclear Power Plants. Vienna; International Atomic Energy Agency (Feb 1975).

From symposium on the physical and biological effects on the environment of cooling systems and thermal discharges at nuclear power stations; Oslo, Norway (26 Aug 1974). See STI/PUB-378; CONF-740820-.

An alternative, new approach to blowdown management for small and medium-sized freshwater evaporative cooling towers is described. This approach is atmospheric dispersion of the blowdown which is accomplished by injecting it through spray nozzles into the exhaust air flow of the cooling tower. The objective of environmental acceptability is formulated and the design criteria and operational conditions are discussed. The most important design parameter is the droplet particle size distribution and the most desired systems operation is the intermittent operation. It is shown that drift transport models and environmental acceptability evaluation methods are applicable to the atmospheric blowdown dispersion concept. An exemplary transport calculation leads to the conclusion that the concept merits further and more detailed examination. (auth)

8358 SPACER FOR FUEL ELEMENTS. Morishima, A.; Kishi, Y. (to Japan Atomic Energy Research Inst.). Japanese Patent 1973-5356/B/. 18 Sep 1965. 3p. (In Japanese).

A spacer apparatus for fuel elements comprises tube members each having protrusive spring portions and wires for coupling the tube members. A large number of parallel wires at equal intervals intersect another set of parallel wires at predetermined angles, and the tube members are disposed at the points of intersection of the wires. Each tube member is formed with apertures in its wall in order to pass the wires therethrough. The fuel elements are elastically urged by the spring portions of the adjacent tube members. Since the spacer structure is composed of tubes and wires, it is easy to fabricate at a low cost, and is high in precision. (JA)

8359 PRESTRESSED CONCRETE PRESSURE VESSEL (PCPV) AND ITS BREAK DOWN TEST. II. Kawamata, S. (Tokyo Univ. (Japan). Inst. of Industrial Science). FAPIG (Tokyo); No. 73, 4-10(Jun 1974). (In Japanese).

A model experiment of PCPV is described. The models used for the experiment are 1/40 scale models of a PCPV. The concrete used was plaster concrete and micro concrete. Prestress was introduced by steel rods and wires. Hydraulic pressure was applied in the models. Maximum inner pressure at breakdown, inner pressure when cracks appear on the surface of the models mode of breakdown, and maximum displacement at breakdown are summarized in a table. The breakdown pressure was three times as high as design pressure. The vessel was elastic below the design pressure. Observed distortion and displacement were in agreement with the results of the analysis by finite element method. Cracks started inside the models when pressure exceeded the design pressure, and the deformation of the models increased with pressure rise. When the pressure was reduced to zero, cracks closed and deformation recovered. Breakdown of the models was seen when the junction of cylinder and slab caused plastic deformation and formed a plastic hinge. (JA)

8360 REACTOR POWER MEASURING SYSTEM. Inoue, K.; Kobayashi, T. (to Hitachi Ltd.). Japanese Patent 1973-18435/B/. 15 Mar 1968. 3p. (In Japanese).

A system for reactor power output determination by measuring the fission yield of fissionable materials is disclosed. The system consists of a pipe which runs inside the reactor and a mass spectrometer connected to the pipe. A gas including fissionable materials such as thorium, uranium, and plutonium etc. is circulated inside the pipe. The output power of the reactor can be determined directly by measuring the fission yield using the mass spectrometer. (JA)

8361 STEAM-GENERATOR TUBE FAILURES: WORLD EXPERIENCE IN WATER-COOLED NUCLEAR POWER REACTORS DURING 1972. Stevens-Guille, P. D. Nucl. Saf.; 16: No. 3, 354-364(1975).

During 1972, approximately one in three operating reactors with steam generators incurred tube failures, predominantly near the tube sheet and in the bend region. Various forms of corrosion were the most frequent cause of failure. Eddy-current inspection was the preferred method for locating and investigating the cause of failure. Extensive use was made of both mechanical and explosive plugs for repair. As a class, steam generators with Monel 400 tubes had the lowest failure rates, and those with Inconel 600 tubes had the highest. (auth)

Reactor Fuels

Refer also to abstracts 6044, 6106–6109, 6385–6387, 6394, 6398, 6948, 6957, 7143, 7153, 7170, 7180, and 7188.

8362 (BN-7410-03) MOPS-C02(VC-2) EXPERIMENT. Final Report. Gaube, M. (Societe Belge pour l'Industrie Nucleaire, Brussels). Oct 1974. 32p. Dep. NTIS (US Sales Only) $4.75.

The MOPS-CO2 (VC-2) experiment is the second coated particles irradiation mounted in the BR2 by BELGONUCLEAIRE and K F A–Jülich. The vented upper part of the capsule has been loaded with compacts supplied by K F A–Jülich and the non vented lower part has been loaded with compacts supplied by BELGONUCLEAIRE. The irradiation started in February 1971 with the cycle 02/71 and ended in April 1972 with the cycle 03/72 where the R/B for ^{133}Xe reached the value of 10^{-3}. The two purposes of the experiment were: the irradiation of compacts at the power reactor fuel peak conditions, e.g., 1250°C, 3×10^{21} DNE and 7% FIMA; and the study of the feasibility of the rig and sweep loop concept and of their satisfactory operation. 13 references. (auth)

8363 (CEA-CONF-2786) FUNDAMENTAL RESULTS ON IRRADIATED CARBIDES: FISSION PRODUCTS RELEASE, FUEL SWELLING AND EVOLUTION OF COMPOSITION. Mikailoff, H. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France)). 1974. 10p. (CONF-741017-25). Dep. NTIS (US Sales Only) $4.00.

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974).

Thermal neutron irradiation studies were performed to evaluate the in-pile behavior of mixed carbide fuels. Information was obtained on fission product release, fuel swelling, and changes in composition. (TWR)

8364 (CONF-750607-13) HISTORY OF COATED PARTICLES. Scott, J. L. (Oak Ridge National Lab., Tenn. (USA)). 1975. 7p. Dep. NTIS $4.00.

From American Nuclear Society meeting; New Orleans, Louisiana, USA (8 Jun 1975).

Research and development programs from 1945 to the present on coated-particle fuels are reviewed. 11 references. (DCC)

8365 STRUCTURE OF NUCLEAR FUEL ROD. Morishima, A.; Kido, T. (to Sumitomo Electric Industries Ltd.). Japanese Patent 1973-5357/B/. 15 Jun 1967. 3p. (In Japanese).

A fuel rod is so constructed that an upper spring as well as a collar and lower spring are respectively disposed above and below fuel pellets within a fuel sheathing pipe. At the lower spring portion, the lower end of a spring clamp protrudes into the collar through an aperture at the upper end of the collar. A flange is provided at the lower end of the spring clamp inside the collar, so that the spring clamp can vertically move within the collar without it becoming disengaged from the collar. The lower spring is interposed between the collar and the upper end of the spring clamp. The resiliency of the lower spring suffices to support the pellets. This fuel rod structure is advantageous in that the lower ends of the fuel pellets are uniform in all the fuel rods, and in that the fuel pellets can move in both the upward and downward directions when thermally expanded during operation. (JA)

8366 PLUTONIUM RECYCLE CONSIDERATIONS. Fuller, E. D.; Briggs, A. pp 1.1-1.11 of Energy, Environment, and Engineering. Stillwater, OK; Oklahoma State Univ. (1973).

From Proceedings on frontiers of power technology; Stillwater, Oklahoma, USA (10 Oct 1973). See CONF-731097-.

Some aspects of plutonium recycle are examined. Topics discussed include alternatives for the use of discharged plutonium, fuel burial and storage considerations, LWR recycle versus storage for breeder reactor use, BWR Pu recycle design, fuel cycle costs, Pu recovery, and Pu fabrication. (JWR)

Reactor Control Systems

8367 (CEA-CONF-2657) DETECTORS FOR REACTOR CONTROL: FISSION CHAMBERS AND BORON LINED COUNTERS. Duchene, J. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Services d'Electronique). 14 May 1974. 21p. (In French). INIS.

From meeting of the French Health Physics Society; Brive-la-Gaillarde, France (16 May 1974).

Neutron detectors, forming the interface between process and control systems in reactors take a direct part in availability and working safety. As a result the most important qualities demanded of these instruments are stability of operation, reliability and long lifetime. In the special case of boron deposit proportional counters and fission chambers the diversity of the systems developed and the yields obtained are reviewed. (FR)

8368 (CONF-750413-P1, pp III.1-III.31) SURVEY OF OPTIMAL CONTROL METHODS. Rao, H. S.; Frogner, B.; Larson, R. E. (Systems Control, Inc., Palo Alto, CA). 1975.

From ANS computational methods in nuclear energy; Charleston, South Carolina, USA (15 Apr 1975).

In proceedings of the conference on computational methods in nuclear engineering. Vol. I. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.; Energy Research and Development Administration, Aiken, S. C. (USA). Savannah River Operations Office).

A brief survey is presented of optimal control methods and applications to nuclear systems. The section on theory covers selected topics in deterministic control, state estimation, combined estimation and control, parameter estimation, and adaptive control. Computational methods surveyed include the application of nonlinear and dynamic programming to unconstrained and constrained control problems. The section on applications surveys analytical aspects related to operational control of nuclear power plants. (97 references) (auth)

8369 (CONF-750413-P1, pp III.33-III.49) REACTOR OPTIMAL CONTROL. Grumbach, R. (Technische Univ., Munich). 1975.

From ANS computational methods in nuclear energy; Charleston, South Carolina, USA (15 Apr 1975).

In proceedings of the conference on computational methods in nuclear engineering. Vol. I. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.; Energy Research and Development Administration, Aiken, S. C. (USA). Savannah River Operations Office).

Reactor optimal control is presented under the aspect of applying optimality considerations throughout the development of a nuclear power plant control system. A qualitative outline of the practical stages in the design procedure is presented starting from the specification of the plant and its requested operational characteristics and ending at the implementation of parameter-optimized subsystems for separable control problems. (30 references) (auth)

8370 (CONF-750413-P1, pp III.51-III.65) EVOLUTION OF OPTIMIZATION STUDIES IN JAPAN. Sato, K. (Electrotechnical Lab., Tokyo); Suda, N.; Kiyose, R.; Iwazumi, T.; Monta, K.; Kawai, T.; Shinohara, Y. 1975.

From ANS computational methods in nuclear energy; Charleston, South Carolina, USA (15 Apr 1975).

In proceedings of the conference on computational methods in nuclear engineering. Vol. I. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.; Energy Research and Development Administration, Aiken, S. C. (USA). Savannah River Operations Office).

Optimization techniques have been applied to various problems in nuclear engineering, such as time optimal control, core and fuel management and system design. Recent activities in Japan are reviewed with some stress on the core and fuel management programming. The model for analysis have evolved from simple to complex, or idealized to practical; the techniques have generally shifted from analytic and theoretical to non-analytic, searching and heuristic correspondingly. Studies in some areas are now providing optimization tools utilized in actual practices. (53 references) (auth)

8371 (CONF-750413-P1, pp III.67-III.85) LOAD FOLLOW STUDIES OF A POWER REACTOR SUBJECT TO SPATIAL XENON OSCILLATION. El-Bassioni, A. A.; Impink, A. J. Jr.; Poncelet, C. G. (Carnegie-Mellon Univ., Pittsburgh). 1975.

From ANS computational methods in nuclear energy; Charleston, South Carolina, USA (15 Apr 1975).

In proceedings of the conference on computational methods in nuclear engineering. Vol. I. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.; Energy Research and Development Administration, Aiken, S. C. (USA). Savannah River Operations Office).

A simple model was used to describe xenon-induced power-shift-triggered oscillations and a number of control policies previously suggested to provide preventative and/or remedial controls were re-examined. The introduction of phase plane trajectories readily generated from control room data proved very effective in characterizing the influence of the various control actions and pointed to the adopted suboptimal policies as efficient, effective and simple. (5 references) (auth)

8372 (CONF-750413-P1, pp III.87-III.113) REFORMULATION OF THE XENON OPTIMAL CONTROL PROBLEM USING LAMBDA MODES. Chiang, A. T.; Beckner, W. D.; Rydin, R. A. (Univ. of Virginia, Charlottesville). 1975.

From ANS computational methods in nuclear energy; Charleston, South Carolina, USA (15 Apr 1975).

In proceedings of the conference on computational methods in nuclear engineering. Vol. I. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.; Energy Research and Development Administration, Aiken, S. C. (USA). Savannah River Operations Office).

An optimal control strategy for damping a one-dimensional xenon-induced spatial power oscillation in a minimum time can readily be derived using Pontryagin's Minimum Principle; this leads to a "bang-bang" or step change type of control policy. Such a solution has been obtained previously by El-Bassioni and Poncelet using a natural mode formulation of the flux, xenon and iodine equations; the natural mode formulation contains several drawbacks. In the present work, the minimum time optimal control problem has been reformulated in terms of the lambda mode solutions to the static reactor balance equations. Furthermore, the physically meaningful spatial xenon and iodine imbalances have been used to form the axes of the control phase plane. The reactor state can readily be found using the measured flux tilt, the rate of change of flux tilt and the correlation between flux tilt, perturbing reactivity and effective eigenvalue separation. A series of reactor simulations has been performed using the nodal 3D code NOXE3. Not only have xenon oscillations been suppressed in an optimal manner, but strategies have also been formulated to deal with overshoots or undershoots caused by late or early switching relative to the true theoretical switching curve. (12 references) (auth)

8373 (GA-A-13081) GAS TURBINE HTGR POWER PLANT CONTROL AND SAFETY STUDIES. Quarterly Progress Report, April 1, 1974-June 30, 1974. (Gulf General Atomic Co., San Diego, Calif. (USA)). 18 Sep 1974. Contract AT(04-3)-167. 127p. Dep. NTIS $5.45.

The steady-state and transient performance of the Gas Turbine HTGR with bypass flow from the core inlet duct is analyzed. Design of breakaway couplings to preserve the integrity of the shaft connecting the turbocompressor to the generator is discussed. Inventory control methods and internal depressurization accident effects, are examined. Circulating water system failure and helium leakage into water systems are discussed. Requirements for a Loop Demonstration Test Facility and a program for fission product plateout and decontamination studies are also discussed. (auth)

8374 (JAERI-M-5844) TECHNICAL DEVELOPMENT OF COMPUTER CONTROL OF OWL-0. (Japan Atomic Energy Research Inst., Tokyo). Sep 1974. 155p. (In Japanese). INIS.

The computerized operation system of the OWL-0 (Oarai Water Test Loop -0) has been developed for the basic study of computer control of power reactors. Design criteria on computerization, dynamic analysis and control parameter survey, hardware and software system design, and treatment of malfunctions are described in detail. The results of the system operation tests are given, and the problems encountered throughout the work are also discussed. (auth)

8375 (RN-S-0288) NRX/EST MALFUNCTION ANALYSIS. (Aerojet-General Corp., Sacramento, Calif. (USA)). Jun 1966. 120p. Dep. NTIS $9.00.

Declassified 10 Sep 1973.

Prior to the NRX engine system tests it was necessary to determine if engine integrity and safety could be maintained in case of component failures. The malfunction study was initiated to examine the consequences of such component failures. To accomplish this task, the common analog model (CAM-II) was

used to simulate the basic engine, its controls, and facility line during emergency shutdown. The limiters, emergency shutdown systems and the results of the simulation tests are described. (auth)

8376 (RT/ING-(74)15) ROLE OF DIGITAL AND HYBRID SIMULATION AS A TOOL IN DESIGNING A NUCLEAR PLANT CONTROL SYSTEM. Di Porto, P.; Vaccarino, G. (Comitato Nazionale per l'Energia Nucleare, Rome (Italy)). 1974. 26p. (CONF-730704-4). Dep. NTIS (US Sales Only) $4.50.

From computer simulation conference; Montreal, Canada (17 Jul 1973).

An integrated use of the digital and hybrid simulation in designing a nuclear reactor control system is described. The basic criteria used for defining the working areas and the models used on both machines are outlined. An analysis of the results is made with respect to time-saving and economy of this working criteria. (auth)

8377 QUANTIFICATION OF MAN–MACHINE SYSTEM RELIABILITY IN PROCESS CONTROL. Nucl. Saf.; 16: No. 3, 316-317(1975).

An overview of the subject of operator reliability in the nuclear industry is presented by both a digest of a previously published paper and an added short bibliography. (7 references) (auth)

8378 TESTS ON PHENIX NUCLEAR POWER PLANT. Control System Testing. Leveque, R. (Societe Technique pour l'Energie Atomique (Technicatome), Centre d'Etudes Nucleaires de Saclay, 91- Gif sur-Yvette (France)); Prouteau, L. (Electricite de France, 75- Paris). Bull. Inf. Sci. Tech. (Paris).; No. 199, 81–86(Jan 1975). (In French).

Owing to the success of the control system testing, each of its functions was operational at the time of the mechanical, hydraulic and general tests on Phenix. This result was obtained by the establishment of and adherence to a strict test sequence and by the use of electrical and physical simulation methods. The development and results of the main control tests (general functional tests and specific control system tests) are presented to illustrate the organization and the methods. Finally no untimely control rod drop was recorded for technological reasons over the entire safety system. (FR)

Nuclear Power Plant Economics

8379 (AED-CONF-74-600-001) THE DEVELOPMENT OF NUCLEAR ENERGY UTILIZATION IN THE FRG. Eitz, A. W. (Rheinisch-Westfaelisches Elektrizitaetswerk A. G., Essen (F. R. Germany)). 1974. 27p. (In German). INIS.

From Symposium on natural uranium supply; Mainz, F. R. Germany (18 Nov 1974).

The possibilities of utilizing nuclear power in the Federal Republic of Germany are investigated on the basis of qualitative and quantitative estimates and data. The paper refers to the development of the nuclear power requirement and the way this will be met, the reserves of primary energy sources available, the development of the electricity generating capacities in the Federal Republic up to 1985, the contribution of nuclear power towards meeting the requirement, the special problems entailed by the introduction of nuclear power plants, the ways and means of meeting the uranium requirement, and the future development of nuclear power. (GE)

8380 (BNWL-SA-5285) STUDY OF HANFORD AS A NUCLEAR ENERGY CENTER. Harty, H. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 24 Feb 1975. Contract AT(45-1)-1830. 9p (CONF-750227-1). Dep. NTIS $4.00.

From Health Physics Society meeting; Richland, Washington, USA (24 Feb 1975).

A study was made of the possible construction of a large nuclear park involving several reactors at Hanford. Savings resulted from continuity of construction, standardization, modularization, fuel cycle treatment, etc. The planning involved consideration of energy transmission cost (0.3 to 0.4 mills/KW-hr) but with present transmission systems up graded to 500 or 1100 KV. Water resources were adequate, but there was some question of how close the reactors could be to each other in view of the large waste heat effluents from each. Earthquake and other common mode failure possibilities were considered. Due to further questions about safeguards of plutonium materials and nuclear waste transportation, more work is being done on the Hanford nuclear park concept. (LTN)

8381 (CONF-750413-P2, pp IV.93-IV.117) NEW DEVELOPMENTS REGARDING THE USE OF SIMULATION MODELING TO THE PLANNING OF ELECTRICITY SUPPLY. Turnage, J. C. (Oak Ridge Y-12 Plant, TN); Bennett, L. L. 1975.

From ANS computational methods in nuclear energy; Charleston, South Carolina, USA (15 Apr 1975).

In proceedings of the conference on computational methods in nuclear engineering. Vol. II. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.; Energy Research and Development Administration, Aiken, S. C. (USA). Savannah River Operations Office).

In the spring of 1972, the Bell Journal of Economics and Management Science published a paper by Dennis Anderson which formulated the electricity supply investment problem in cost minimization form and went on to review various approaches used to find optimum solutions to the problem. Anderson pointed out that the investment problem is simply a statement of the investor's objective to minimize the sum of capital and operating costs over some future time period, given the existence of several important constraints. Anderson observed that the various approaches used to solve the investment problem could be categorized into three different classes: marginal analysis, marginal analysis using simulation, and global models. Much of what has happened over the last three years regarding the second of these categories, the use of simulation techniques in the planning of electricity supply, is reviewed. 51 references. (auth)

8382 (NP-20380) STATUS REPORT: ENERGY RESOURCES AND TECHNOLOGY. (Atomic Industrial Forum, Inc., New York (USA)). 1974. 355p. AIF $40.00; $20.00 members.

The purpose of the study was to provide under one cover an encyclopedia of fuels information to assist the utility manager in making future generation plans. The report, which includes a brief executive summary, highlights the potential of each of the energy forms in both the near and long-term. It examines the capability of potential energy sources such as solar and geothermal and indicates the effort required to develop these sources and the likely amounts of energy available from them in the long-term. Separate abstracts were prepared for 3 sections on nuclear power. (HDR)

For abstracts of individual sections see: 6206, 8026, and 8071.

8383 BRAZIL'S NEW NUCLEAR PROGRAM. Com. Naz. Energ. Nucl., Not.; 21: No. 2, 55-57(Feb 1975). (In Italian).

This nation's new nuclear program envisages for the next 15 years the construction of nuclear power plants to a total capacity of 11,000 MW(e) and of 60,000 to 70,000 MW(e) by the end of the century. This will involve a major industrial development activity and the exploitation of the country's uranium resources, which are considered sufficient to meet domestic requirements through 1980. (auth)

8384 TOWARDS THE PREDOMINANCE OF NUCLEAR-GENERATED ELECTRIC POWER. Angelini, A. M. Com. Naz. Energ. Nucl., Not.; 21: No. 2, 19-34(Feb 1975). (In Italian).

Electric power from nuclear sources will play a decisive role in the pattern of energy consumptions and by 1980 in the industrialized countries it should account for about one fifth of all production, for about 35-40% by 1985, for 60-70% by 1990 and for 80-90% by 2000. In Italy, a fast and intensive growth of nuclear energy assumes even greater importance because of the nation's heavy dependence on oil imports, which place an intolerable burden on its balance of payments. Each 1000-MW(e) nuclear power plant (this being the capacity of the four ordered by ENEL in 1973 and 1974) can yield Italy a saving of tens of billions of Lire a year as compared to an oil-burning plant and annual lightening of the balance of payments in the order of 40 billion Lire. It should also be borne in mind that, as regards the construction of plants, the Italian industry is already capable of turning out structures and components accounting for more than 80% of the cost of any plant. The current programs – including the Caorso 850-MW(e) plant, now in an advanced construction stage and the four 1000-MW(e) units ordered in 1973 and 1974 – and the plans for the immediate future, calling for units to a total capacity of 14,000 to 20,000 MW(e) to be ordered in 1975-79 and units totaling 27,000 to 36,000 MW(e) to be ordered in 1980-84, will require, in addition to a tremendous financial effort (a problem whose solution is a vital condition for the implementation of the nuclear program), the availability within a relatively short time of sites for the erection of the nuclear plants. (auth)

8385 KOREA'S EXPERIENCES IN IMPLEMENTING A NUCLEAR POWER PROGRAMME. Lee, B. W. (Atomic Energy Bureau, Seoul). Int. At. Energy Agency Bull.; 17: No. 1, 33-39(Feb 1975).

Korea's experience in implementing a nuclear power program is reviewed with the idea of providing advice to other developing countries in the implementation of similar programs. Limited local government and industrial engineering resources were aided considerably by IAEA technical assistance, special missions, conferences, fellowships, etc. The first steps required

feasibility and economic decisions: optimum size of reactor (this increased during the studies due to the industrial growth), site selection, and choice of reactor type (consistent with national policy objectives, economics, stable fuel cycle, minimum foreign exchange, etc). Licensing and regulatory systems had to be developed to protect public health and safety and the environment and to provide adequate financial protection in the event of a nuclear accident (a combination of American and Japanese systems was used). The importance of personnel training in such a program is emphasized and the various means of training discussed (consultants, exchange programs, project management, quality assurance, review, etc.). The program was started in the 1960's and was enlarged as a result of industrial growth and the energy crisis in 1974. (LTN)

Reactor Fuel Cycle Economics

Refer also to abstracts 6595, 8366, and 8370.

8386 (AED-CONF-74-600-002) INFLUENCE OF DIFFERENT REACTOR STRATEGIES AND SUBSTITUTION POSSIBILITIES ON THE REQUIREMENTS OF NATURAL URANIUM. Maerkl, H. (Kraftwerk Union A. G., Erlangen (F. R. Germany)). 1974. 18p. (In German). INIS.

From symposium on natural uranium supply; Mainz, F. R. Germany (18 Nov 1974).

13 figs.

After a forecast is given of the electricity requirement in the Federal Republic of Germany up to the year 2000, the specific parameters are outlined which govern the natural uranium requirements of the different types of reactors. Another important parameter investigated is the tails assay in the enrichment process. On the basis of these assessments the natural uranium requirement of the Federal Republic up to the year 2000 is estimated for single- and multiple-type strategies. This natural uranium requirement will be determined chiefly by the established light water reactor line until the end of the century. (GE)

8387 (CONF-750317-, pp 1-15) IRRADIATED LWR FUEL STORAGE: POTENTIAL FOR GREATER DEMAND. Voigt, W. R. Jr. (Div. of Production and Materials Management, Washington, DC). 1975.

From atomic industrial fuel cycle conference; Atlanta, Georgia, USA (18 Mar 1975).

In AIF fuel cycle conference '75.

As of January 1, 1975, no reprocessing plants are operating, and unused space in Away-From-Reactor storage facilities is sufficient for only 50 metric tons of uranium. Timely operation of the reprocessing plants is the key to avoid reactor shutdowns resulting from filled basins, and careful planning and execution will be required to bring reprocessing capability on line on a timely basis. Delays in availability of reprocessing plants appear to have eliminated the contingency factors in spent fuel disposition, and additional storage capacity may be the only alternative. Reactor basin storage configuration could be modified to permit increased storage without a major construction effort, and some utilities are actively reviewing this option. (auth)

8388 (CONF-750413-P1, pp III.115-III.134) OPTIMIZATION OF IN-CORE FUEL MANAGEMENT, CYCLE PERIOD AND POWER SCHEDULING OF NUCLEAR POWER PLANTS BY LARGE SCALE NONLINEAR PROGRAMMING. Hoshino, T.; Takahashi, M.; Fujii, Y. (Kyoto Univ.). 1975.

From ANS computational methods in nuclear energy; Charleston, South Carolina, USA (15 Apr 1975).

In proceedings of the conference on computational methods in nuclear engineering. Vol. I. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.; Energy Research and Development Administration, Aiken, S. C. (USA). Savannah River Operations Office).

In the light of the strong interaction between in-core fuel management and cycle-power scheduling, the optimization should be carried out over the wider planning horizon of the overall utility system management, before sticking to the details of reactor physics. The report aims at the minimization of the power cost of the utility system, which consists of nuclear power plant(s) and one backup fossil power plant. The decision variables are batch size of the non-equilibrium refueling pattern, cycle power, derating and cycle length. The optimization is subject to several constraints in reactor operation and power system scheduling. The problem characterized by the large scale nonlinear programming, is decomposed in two stages: Suboptimization of nuclear unit by Linear Programming and overall coordinative optimization for system power cost with the use of gradient projection method. A typical example on BWR is studied. In most cases of normal operation, the economical solution is obtained by filling up the margins involved in design parameters and operational constraints. The economic incentive is especially enhanced in the planning of recovery transient after unexpected plant outages or any disturbance to the precalculated operational scheme. (12 references) (auth)

8389 (CONF-750413-P1, pp III.135-III.149) OPTIMIZATION OF IN-CORE FUEL MANAGEMENT BY INTEGER LINEAR PROGRAMMING. Kubokawa, T.; Kiyose, R. (Tokyo Univ.). 1975.

From ANS computational methods in nuclear energy; Charleston, South Carolina, USA (15 Apr 1975).

In proceedings of the conference on computational methods in nuclear engineering. Vol. I. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.; Energy Research and Development Administration, Aiken, S. C. (USA). Savannah River Operations Office).

In-core fuel management analysis involves many decision problems, such as the determination of enrichment and number of fresh fuel subassemblies, reloading patterns and control rod programming. The main constraints, which should be taken into consideration in the optimization study, are power peaking factor, criticality condition, and availability of fuel types. It is very difficult to consider the factors and constraints in a unified rigorous physical context, therefore a simplified model for reactor core becomes indispensable. A simplified estimation method for power distribution and reactivity by a power response matrix is proposed, and it is extended to deal also with control rod programming and with rudimentary burnup process. An Integer Linear Programming computer code has been developed and applied for the decision of optimal reloading and control rod patterns. The optimal reloading and control rod patterns to minimize the required quantities of fresh fuels are simultaneously determined under the constraints of power peaking factor limitation and criticality. (15 references) (auth)

8390 (EPRI-SR-6) EPRI PROGRAMS ON PLUTONIUM FUEL UTILIZATION. Zolotar, B. A.; Lapides, M. E.; Gelhaus, F. E. (Electric Power Research Inst., Palo Alto, Calif. (USA)). Feb 1975. 11p. (CONF-741153-25). NTIS.

From panel on plutonium utilization in thermal power reactors; Karlsruhe, F. R. Germany (25 Nov 1974).

The Electric Power Research Institute (EPRI) has instituted (with other groups) a study of several alternatives which exist in possible plutonium recycle in water reactors. Plutonium recycle generally exhibits a positive credit value for LWRs, but the credit may not be large enough to justify possible complications. In these circumstances it is necessary to examine carefully and determine costs precisely of a large number of alternatives The relative values of these alternatives have not been constant but have changed with time due to safeguards requirements, characteristics of available reactors, storage costs (of spent fuel or recovered Pu), market value of plutonium, market value of uranium, enrichment capacity, fuel refabrication costs, licensing requirements and, indeed, the availability of proven reprocessing methods. The costs of many of these alternatives cannot be determined precisely at present or they may be changing due to such factors as the energy crisis. The experimental part of the EPRI program is devoted to evaluating the costs and problems in some of these operations. Workshops have been held to examine various aspects of the overall problem. (LTN)

8391 (ERDA-33) NUCLEAR FUEL CYCLE. (Energy Research and Development Administration, Washington, D. C. (USA)). Mar 1975. 107p. Dep. NTIS $5.45.

A detailed analysis of the commercial nuclear fuel cycle including exploration, mining, enrichment, fabrication, reactor use, spent fuel storage, reprocessing, waste disposal, transportation, and plutonium recycle is presented. (JWR)

Reactor Licensing and Regulation

8392 (BAW-10096A(Rev. 1)) B AND W NPGD QUALITY ASSURANCE PROGRAM FOR NUCLEAR EQUIPMENT. Revision 1. (Babcock and Wilcox Co., Lynchburg, Va. (USA). Nuclear Power Generation Div.). Mar 1975. vp. Babcock and Wilcox, Lynchburg, VA.

B and W's Quality Assurance Program (QAP) is described. The program is implemented through the Nuclear Power Generation Division (NPGD) and includes design, procurement, and manufacturing activities of NPGD and all its suppliers furnishing items in the B and W scope of supply including other Divisions/Subsidiaries of B and W. These activities are controlled by including applicable quality assurance requirements, as described, in NPGD procurement documents imposed on its suppliers. Each supplier must then establish and/or maintain a documented QA

Program to meet the requirements imposed by the procurement documents. Implementation of the suppliers' NPGD-approved QA Program is verified by NPGD through Audit and QC Surveillance activities. The position and relationships of the NPGD within the Company's corporate structure are described. An overview of the QAP describing its implementation, its operation, the controls imposed on all suppliers (both corporate and vendor) and site consulting activities is presented. (auth)

8393 (DOCKET-50010-398) DRESDEN NUCLEAR POWER STATION, UNITS 1, 2, AND 3. Semiannual Report on Operating and Maintenance, July-December 1974. (Commonwealth Edison Co., Chicago, Ill. (USA)). 23 May 1975. 253p. (DOCKET-50237-292; DOCKET-50249-623). Dep. NTIS $15.75.

Unit 1 generated 388,882 MWH(e) and was on line 3111.2 hours, Unit 2 generated 1,204,106 MWH(e) and was on line 2013.4 hours, and Unit 3 generated 2,250,810 MWH(e) and was on line 3836 hours. Information is presented concerning operations, shutdowns, maintenance, changes, tests, and experiments for the three units. (FS)

8394 (DOCKET-50250-364) TURKEY POINT PLANT, UNITS 3 AND 4. First Year Operating Report. (Florida Power and Light Co. (USA)). 8 May 1975. 41p. (DOCKET-50251-348). Dep. NTIS $5.25.

Information is presented concerning performance to date in comparison with design predictions and specifications; reassessment of the safety analysis submitted with the license application; assessment of structures, systems, and components important to safety; and a progress and status report on items requiring additional information. The first year of commercial operation was satisfactory; however, unit availability and performance are expected to be improved as a result of solving problems associated with start-up of a new facility. (FS)

8395 (DOCKET-50321-244) EDWIN I. HATCH NUCLEAR PLANT, UNIT 1. Semiannual Operating Report, September 12-December 31, 1974. (Georgia Power Co., Atlanta (USA)). 1974. 68p. Dep. NTIS $6.50.

Hatch-1 achieved initial criticality on September 12, 1974, and initial synchronization on November 11, 1974. The unit is a BWR of 813 MW(e) and has generated 50,775.6 MWH since September 12 with the generator on line 865.62 hours. Net plant efficiency was 20.88 percent with plant availability of 28.32 percent. Information is presented concerning operations, changes, tests, safety related maintenance, primary coolant chemistry, occupational personnel radiation doses, and radioactive effluent releases. (FS)

8396 (DOCKET-STN-50532-1) STANDARD TURBINE ISLAND DESIGN, SAFETY ANALYSIS REPORT. Braun, C. F. (Braun (C. F.) and Co., Alhambra, Calif. (USA)). 18 Dec 1974. 689p.

A standard turbine island used with a BWR is described. It consists of the turbine-generator; steam system; condensate storage, cleanup, and transfer systems; control and instrumentation; water treatment plant; make-up demineralizer; potable and waste water systems; and a compressed air system. The turbine-generator is a tandem-compound nuclear-type turbine with one double-flow high-pressure section and a six-flow low-pressure section in three double-flow low-pressure casings. The turbine is directly connected to an 1800 rpm synchronous a-c generator. A combined moisture separator and two-stage reheater is provided. The main steam system delivers the steam generated in a BWR to the main turbine stop valves. The condensate system maintains proper water inventory. Protective features prevent loss of the system due to electrical failure of a component and isolates faults to ensure continuity of a power supply from alternate sources. (FS)

8397 (DOCKET-STN-50535-1) GASSAR-6 (GENERAL ATOMIC STANDARD SAFETY ANALYSIS REPORT). Volume 2. (General Atomic Co., San Diego, Calif. (USA)). 3 Feb 1975. 565p. (GA-A-13200(Vol.1)). Dep. NTIS $31.25.

A standard nuclear steam system for a 3000 MW(t), 1160 MW(e) high temperature gas-cooled reactor (HTGR) nuclear power station is described. The HTGR operates on a uranium-235/thorium-232 cycle. Spherical fuel pellets are coated with multiple layers of pyrolytic carbon, bonded into rods, and encased in hexagonal graphite fuel elements. The core is nuclear-purity-grade, near isotropic graphite machined in hexagonal blocks, which serves as moderator and the heat transfer medium between the fuel and the coolant. Forced helium is the primary coolant and water is the secondary coolant. A prestressed concrete reactor vessel (PCRV) houses the reactor core, primary coolant system and portions of the secondary coolant system, steam generators and circulators. A continuous internal steel liner in the PCRV acts as the primary coolant boundary and sealing membrane. The control rods contain boron carbide in a graphite matrix sheathed in Incoloy 800 cans. Boron constitutes about 40 percent of the absorber material by volume. The control rod drives provide insertion and withdrawal rates consistent with the required reactivity changes for operational load fluctuations and reactor shutdown. Control rods have shim and trip capability. (FS)

8398 (FIND-50206-R1) FIND: SAN ONOFRE NUCLEAR GENERATING STATION, UNIT 1. Carter, E. P. (ed.). (Energy Research and Development Administration, Oak Ridge, Tenn. (USA). Technical Information Center). Mar 1975. 42p. Dep. NTIS $4.00.

A guide is given for Docket 50206 microfiche items (1-336) which have been received by the US ERDA, Technical Information Center (TIC) through January 1975. This FIND covers three stages of San Onofre Nuclear Generating Station Unit 1: construction-permit, provisional-operating-license, and full-term-operating-license. For each stage, the docket report material is presented according to document grouping: Commonwealth Edison Company application information (general, technical, environmental) and the NRC review (by Advisory Committee on Reactor Safeguards, Directorate of Licensing, Directorate of Regulatory Operations, Regulatory Adjudication). Issuances pertinent to the full-term-operating-license stage are indexed in greater depth than are the issuances of the two earlier stages. Subject citations identify the TIC item numbers and the microfiche sheet-frame numbers. Entries indicate, when applicable, superseded and supplemental items. (auth)

8399 (FIND-STN-50508) FIND: WPPSS NUCLEAR PROJECT NO. 3 AND NO. 5. Williams, W. H. (ed.). (Energy Research and Development Administration, Oak Ridge, Tenn. (USA). Technical Information Center). May 1975. 35p. Dep. NTIS $4.00.

An index is presented for the docket report material submitted in conjunction with the application for a nuclear power plant construction permit and operating license. The index citations are to the beginnings of major headings, sections, responses, etc., and refer to grid coordinates on microfiche sheets prepared for each docket report. (DCC)

8400 (NEDO-10802-01(Amend. 1)) ANALYTICAL METHODS OF PLANT TRANSIENT EVALUATIONS FOR THE GE BWR. Amendment No. 1. Linford, R. B. (General Electric Co., San Jose, Calif. (USA). BWR Projects Dept.). Apr 1975. 21p. General Electric Co., San Jose, CA 95125.

In this amendment of a Licensing Topical Report, additional information is provided in response to requests from the USAEC Regulatory Staff concerning several detailed features of the mathematical models. (LTN)

8401 (NP-20376) QUALITY ASSURANCE PROGRAM. Braun Topical Report 21. (Braun (C. F.) and Co., Alhambra, Calif. (USA)). 11 Apr 1975. 31p. C. F. Braun and Co., Alhambra, CA.

The Quality Assurance (QA) policies and procedures described have been developed specifically for use in commercial nuclear projects. These policies and procedures are intended to provide assurance to Braun Management and the client that the plant will be safe, reliable, and operable, plus meet the requirements of the Nuclear Regulatory Commission, NRC. The Braun QA Manual provides QA procedures for (1) engineering and design, (2) procurement of materials, equipment, and services, and (3) construction and installation. The controls for safety-related systems established in the manual cover all phases of work from project inception to plant completion prior to operation by the owner. The manual standardizes Braun QA control procedures. These procedures are supplemented by Project QA Instructions prepared for each project. (auth)

8402 (NUREG/PRDI-75/4) POWER REACTOR DOCKET INFORMATION. (Energy Research and Development Administration, Oak Ridge, Tenn. (USA). Technical Information Center). Apr 1975. 72p. TIC $1.85.

8403 (REG/G-1.70.27(4-75)) INFORMATION FOR SAFETY ANALYSIS REPORTS: RADIOACTIVE WASTE MANAGEMENT. (Nuclear Regulatory Commission, Washington, D. C. (USA). Office of Standards Development). Apr 1975. 14p. NRC.

Safety Analysis Report requirements pertaining to radioactive source terms, waste management systems, and radioactive releases are presented for liquid, gaseous, and solid radioactive wastes. Information requirements concerning effluent monitoring and sampling equipment and procedures are also specified. (DG)

8404 (REG/G-1.70.28(4-75)) INFORMATION FOR SAFETY ANALYSIS REPORTS: STEAM AND FEEDWATER SYSTEM MATERIALS. (Nuclear Regulatory Commission, Washington, D. C. (USA). Office of Standards Development). Apr 1975. 3p. NRC.

Safety Analysis Report requirements pertaining to fracture toughness test methods and acceptance criteria and selection and fabrication methods used for steam and feedwater system materials are listed. (DG)

8405 (REG/G-1.70.29(4-75)) INFORMATION FOR SAFETY ANALYSIS REPORTS: METEOROLOGY. (Nuclear Regulatory Commission, Washington, D. C. (USA). Office of Standards Development). Apr 1975. 6p. NRC.

Safety Analysis Report requirements pertaining to site meteorologic conditions, parameters, and data are listed. (DG)

8406 (REG/G-1.70.31(5-75)) INFORMATION FOR SAFETY ANALYSIS REPORTS: PLANT PROCEDURES. (Nuclear Regulatory Commission, Washington, D. C. (USA). Office of Standards Development). May 1975. 5p. NRC.

8407 (REG/G-1.70.32(5-75)) INFORMATION FOR SAFETY ANALYSIS REPORTS, REACTOR WATER CLEANUP SYSTEM. (Nuclear Regulatory Commission, Washington, D. C. (USA). Office of Standards Development). May 1975. 4p. NRC.

8408 (REG/G-1.96(5-75)) DESIGN OF MAIN STEAM ISOLATION VALVE LEAKAGE CONTROL SYSTEMS FOR BOILING WATER REACTOR NUCLEAR POWER PLANTS. (Nuclear Regulatory Commission, Washington, D. C. (USA). Office of Standards Development). May 1975. 5p. NRC.

8409 (REG/SPR-17.2) QUALITY ASSURANCE DURING THE OPERATIONS PHASE. (USAEC Directorate of Licensing, Washington, D. C.). 1974. 21p. NRC.

The Regulatory Standard Review Plan of the Directorate of Licensing for reviewing the quality assurance plan of nuclear plant operators is presented. (LTN)

8410 (TID-26811) ATOMIC ENERGY COMMISSION REPORTS. Volume 6. Opinions and Decisions of the Atomic Energy Commission With Selected Orders, January 1, 1973 to December 31, 1973. (USAEC, Washington, D. C.). 1974. 1349p. GPO $16.15.

Issuances of the Atomic Energy Commission, the Atomic Safety and Licensing Appeal Boards, the Atomic Safety and Licensing Boards, and the Board of Contract Appeals including the Contract Adjustment Board are presented. (DCC)

8411 CAN THE CRITERIA AND METHODOLOGY USED FOR RADIOACTIVE DISCHARGES BE APPLIED TO THERMAL DISCHARGES? Coulon, R.; Lacourly, G.; Bovard, P. (CEA, Fontenary-aux-Roses, France). pp 675-681 of Environmental Effects of Cooling Systems at Nuclear Power Plants. Vienna; International Atomic Energy Agency (Feb 1975). (In French).

From symposium on the physical and biological effects on the environment of cooling systems and thermal discharges at nuclear power stations; Oslo, Norway (26 Aug 1974). See STI/PUB-378; CONF-740820-.

In France, as in most other countries, authorizations for thermal effluent discharges and instructions regarding the methods to be employed are issued following studies on a case-by-base basis, due account being taken of the specific characteristics of each site and in particular of the use to which the receiving waters are being put. Among the methods advocated for estimating population exposures to radiation, the critical path method is very much in favor at present. Possible similarities are considered between the problems caused by thermal effluent and by radiation exposure. Examining those areas where the two problems converge and diverge, bearing in mind the fact that damage caused by thermal discharges mainly affects the environment whereas radiation protection is concerned principally with man as the most sensitive species, it is concluded that there are certain approaches which can be adopted in dealing with both problems, including the determination of critical points, the application of cost-benefit concepts (justification of the damage incurred) and the application of cost-effectiveness concepts (optimization). (auth)

8412 IAEA PLANS FOR ESTABLISHING SAFETY CODES AND GUIDES FOR NUCLEAR POWER PLANTS. Servant, J.; Iansiti, E. Int. At. Energy Agency Bull.; 17: No. 1, 2-4(Feb 1975).

The safety of nuclear power plants in any country rests on many requirements. One is an adequate supply of trained personnel for the work involved and to staff a regulatory agency. Another is the ability to conduct a careful and detailed safety evaluation of a nuclear power plant project from its inception and at all stages throughout its life. A third is the ability to conduct an appropriate quality assurance program including control and inspection. If these requirements are met, it is possible for the authorities of the country to assure themselves that nuclear power plants can be built and operated safely. Formalized safety criteria in the form of codes, guides, etc. can be of considerable assistance in ensuring that these basic requirements are understood and met. It must be emphasized, however, that safety criteria cannot be treated in isolation, and can only be used effectively by qualified personnel. Similarly, it is essential that regulatory and project personnel of a country proposing to build a nuclear power plant obtain in-depth knowledge of the characteristics of the type of plant it plans to build and operate and of the available body of pertinent information related to safety and regulatory activities, particularly in the country of origin of the plant. (auth)

GENERAL AND MISCELLANEOUS

Energy Utilization and Economics

Refer also to abstract 6469.

Law

8413 (IRS-A-7(12-74)) INSTITUTIONS ESTABLISHING RULES AND ENFORCING REGULATIONS. Schlegel, W. (Institut fuer Reaktorsicherheit der Technischen Ueberwachungs-Vereine e.V., Koeln (F. R. Germany)). Dec 1974. 125p. (In German). Dep. NTIS (US Sales Only) $9.25.

The compilation gives a survey on German and important French, English and North American as well as some important international institutions, being concerned with the establishment of rules and guides or otherwise sponsoring those activities. All matters of interest were considered in sections on origin, tasks, organization, and activities. (auth)

8414 (PB-228865) NEPA (NATIONAL ENVIRONMENTAL POLICY ACT): SOME LEGAL CONSTRAINTS AS SET FORTH BY THE COURT IN CALVERT CLIFFS. Report on National Energy Needs and Environmental Quality. Best, J. A. (Cornell Univ., Ithaca, N. Y. (USA)). Oct 1971. 26p. NTIS $3.25.

The expanded jurisdiction and duties of the federal agencies under the National Environmental Policy Act (NEPA) are examined and the implications for judicial review are analyzed. NEPA has substantially enlarged the jurisdiction of the federal agencies and created new substantive and procedural duties designed to prevent and eliminate environmental damage. The most important consequence of NEPA is that it shifts the burden of proof to the initiator of energy producing projects; this shift is based upon the policy that those who would disturb the environment must be able to justify their proposed activities. In the most important post-NEPA case to date, Calvert Cliffs v. AEC, the court broadly construed the new NEPA duties and adopted the view that NEPA applies to existing programs and ongoing activities. This case is analyzed in detail because it contains the most systematic interpretation of NEPA made by the federal courts and because the court interpreted the law as a shift in national priorities. (GRA)

8415 MANAGEMENT OF RADIOACTIVE DRUGS FROM A STANDPOINT OF ADMINISTRATION. Nakazawa, K. (Science and Technology Agency, Tokyo (Japan). Atomic Energy Bureau). Genshiryoku Kogyo; 20: No. 8, 27-30(Aug 1974). (In Japanese).

The control of radioactive medical supplies is discussed from the standpoint of administration. Recent trends of types, doses, and facilities of radioactive medical supplies were tabulated. The present conditions of legal regulations in Japan and the importance of safe control are described. As far as the use of radioactive medical supplies in accordance with the regulations of the medical law enforcement regulations is concerned, facilities, patient control, and the prevention of contamination are explained. Administrative subjects including educational training, establishment of the control system, and intensification of the medical monitoring system based on the medical law are described. (JA)

8416 ATOMNAYA ENERGIYA PRAVOVYE PROBLEMY. (Atomic Energy Legal Problems). Ioirysh, A. I. Moscow; Izdatel'stvo Nauka (1975). 216p. (In Russian).

Legal problems associated with the regulation of the peaceful uses of atomic energy by legal norms are considered. Features of controlling atomic industry in the USA, Great Britain, France, and Germany are examined. Considerable attention is devoted to features of the legal position of atomic tribunals and of legal regulation of the effects of atomic energy on the environment. (SJR)

8417 NEPA AND MULTI-AGENCY ACTIONS: IS THE "LEAD AGENCY" CONCEPT VALID. Humphreys, D. L. (Univ. of California, San Francisco). Natur. Resour. Lawyer; 6: No. 2, 257-264(Spr 1973).

Management

Refer also to abstracts 6385-6389, 6394, 6398, and 8415.

8418 (ARH-SA-212) ATLANTIC RICHFIELD HANFORD COMPANY CHEMICAL OPERATOR TRAINING PROGRAM. Zumhoff, R. G. (Atlantic Richfield Hanford Co., Richland, Wash. (USA)). Jan 1975. Contract AT(45-1)-2130. 11p. (CONF-750515-3). Dep. NTIS $4.00.

From second ANS symposium on training of nuclear facility personnel; Gatlinburg, Tennessee, USA (11 May 1975).

Formal training and testing of Chemical Operators at Hanford were initiated as part of a negotiated union settlement in 1966. Consequently, it was agreed that 25 percent of the chemical operator force would receive a higher rated job (lead Nuclear Chemical Operator) provided they satisfactorily completed a training program including testing. The training and testing program was developed in two parts. The first covered subjects of a general nature and was applicable to an operator's duties no matter what the assignment. Part II was more specifically oriented to the presently assigned work area. Renewed interest in retraining and requalification of all chemical operators was taken in 1971. This evolved from a Company concern that a program be developed to assure the fact that operators were qualified to do their assigned jobs, and an Atomic Energy Commission request for an outline of a retraining and requalification program for chemical operators. Building upon the experience gained in the LNCO (Lead Nuclear Chemical Operator) program, the two part format is retained. The use of video tapes are used to complement the manuals. An arrangement where an operator can view a lecture-type presentation is provided in seven plant locations. A small studio for in-house production of the video tapes is available to the training Specialists. A script is developed from a training manual by condensing the information into 20 minute presentations. A prime objective of each tape is to highlight the safety and control aspects that accompany operator responsibilities in each of these areas. Testing is also handled on a two part basis; one test covers the fundamentals and a separate test is designed for each of the plant subjects. A walk-through examination is also performed for the plant portion. Operators are required to be requalified on emergency procedures on an annual basis and at two-year intervals in the other areas. (auth)

8419 (CONF-750515-2) METHODS FOR TRAINING RADIOCHEMICAL TECHNICIANS AT ORNL. Parrott, J. R.; Nicol, R. G. (Oak Ridge National Lab., Tenn. (USA)). [nd]. 7p. Dep. NTIS $4.00

From 2nd ANS symposium on training of nuclear facility personnel; Gatlinburg, Tennessee, USA (11 May 1975).

The training of personnel to carry out radiochemical operations at ORNL is a formidable and recurrent task since programs are constantly shifting. It is essential that provisions be made for the routine retraining of these personnel if they are to make effective contributions on a continuing basis. Training methods are described that have emerged as a result of thirty years experience in a variety of radiochemical pilot-plant programs. Emphasis is placed on training programs for technicians for the ^{233}U Processing Facility since essentially all aspects of radiochemical operations are encountered in this facility. These programs have included operations performed in glove boxes, hot-cell manipulator work handling high-neutron-emitting isotopes, and the entire spectrum of remote solvent extraction operations. (auth)

8420 (IAEA-167) REGISTER OF MEDICAL RADIOISOTOPE UNITS. Preliminary Edition. (International Atomic Energy Agency, Vienna (Austria)). 1974. 335p. INIS.

The register of medical radioisotope units indicates units, staffing, radioactivity and radiation measuring equipment, and routine clinical activities for the following countries: Algeria, Argentina, Bangladesh, Bolivia, Brazil, Bulgaria, Burma, Chile, Columbia, Costa Rica, Cuba, Ecuador, Arab Republic of Egypt, Ghana, Greece, Hungary, India, Indonesia, Iran, Iraq, Israel, Jamaica, Republic of Korea, Kuwait, Lebanon, Malaysia, Mexico, Morocco, Nigeria, Pakistan, Panama, Paraguay, Peru, Philippines, Poland, Senegal, Sierra Leone, Singapore, Spain, Sri Lanka, Sudan, Turkey, Uganda, Venezuela, Viet-Nam, Yugoslavia, Republic of Zaire, and Zambia. (INIS)

Mathematics and Computers

Refer also to abstracts 6435, 6585, 6673, and 6789.

Miscellaneous

8421 (INIS-mf-1538) FUTURE OF NUCLEAR TECHNOLOGY. Ramanna, R. (Bhabha Atomic Research Centre, Bombay (India)). 1974. 27p. INIS.

After giving a brief introduction to nuclear technology and a few facts concerning the development of atomic energy in India, the new developments in nuclear technology, particularly the breeder reactor in the Indian context are discussed. Attention is drawn to the fact that nuclear power is definitely cheaper than

coal fired plants in places which are distant from the coal mines. Problems to be solved for successful application of breeder reactors as a source of energy are discussed. The Nuclear Fuel Complex, Hyderabad, which produces nuclear fuels for power reactors in India, is briefly described. Developments in fusion power field are reviewed. Applications of radioisotopes and radiation in industry, medicine and agriculture and corresponding research and development work carried on in Bhabha Atomic Research Centre are described. (INIS)

8422 (RISO-M-1791) GROWING SINGLE CRYSTALS OF LITHIUM. Beg, M. M. (Danish Atomic Energy Commission, Risoe. Research Establishment). Apr 1975. 12p. Dep. NTIS (US Sales Only) $4.00.

Large single crystals of lithium-7 were grown by the Bridgman method. Crystals were grown in sealed stainless steel thin walled containers, which could be used directly for the inelastic neutron scattering lattice dynamics experiments. The mosaic spread of the crystals varied between 25′ and 45′. (auth)

8423 (SAND-74-8242) LANCHESTER THEORY IN THE CONTEXT OF TACTICAL NUCLEAR WARFARE. Brandt, L. D.; Basinger, R. C. (Sandia Labs., Livermore, Calif. (USA)). May 1975. Contract AT(29-1)-789. 37p. Dep. NTIS $5.00.

After a brief exposition on Lanchester Theory, a deterministic Lanchester model is developed which combines both conventional and nuclear battle. In addition to conventional modeling (which includes movement, range-dependent effectiveness and target acquisition), a nuclear fire model is developed which allows for delayed kill. Several illustrative examples of applications of the model are presented. (auth)

Chemistry

8424 (CEA-CONF-2902) METALS EXTRACTION BY α AND β-MONOSUBSTITUTED TETRAHYDROFURANS IN CHLORHYDRIC MEDIUM. Laurence, G. J.; Thai, T. L.; Bourguignon, J. R.; Michel, P. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Div. de Chimie). 1974. 21p. INIS.

From international solvent extraction conference; Lyon, France (8 Sep 1974).

The preparation main properties and conditions of use of α and β-monosubstituted tetrahydrofurans for solvent extraction processes are given. Derivatives of tetrahydrofuran are used in their pure state, and placed in contact with aqueous chloride solutions with an acid normality less than or equal to 6. Studies dealing with the extraction of a certain number of metal chlorides (Ga, Sn, Fe, Hg, Zn, Cd) show the influence of the structure of the organic solvents on their extractive properties. Results of extractions of iron(III) and gallium(III) by various tetrahydrofuran derivatives are compared to those obtained using linear ethers. (FR)

Life Sciences

8425 (ORO-2410-33) NITRATE ABSORPTION AND STRONTIUM ACCUMULATION. Annual Progress Report, 1 August 1974-31 July 1975. Jackson, W. A. (North Carolina State Univ., Raleigh (USA). Dept. of Soil Science). Apr 1975. Contract AT(40-1)-2410. 53p. Dep. NTIS $5.75.

Results are reported from studies of the root absorption of nitrates and Sr by corn seedlings. (CH)

8426 (SREL-3, pp 39-68) MINERAL CYCLING PROGRAM. Garten, C. T. Jr.; Gentry, J. B.; Gibbons, J. W. May 1975.

In Savannah River Ecology Laboratory annual report. (Georgia Univ., Athens (USA). Inst. of Ecology).

Progress is reported in the following areas of research: elemental concentrations in vegetation; nitrogen in coastal plain ecosystems; chemical composition of rodents and deer; relationship between foraging patterns and colony migrations of harvester ants; heavy metal transport by suspended particulates in streams; and length-weight relationships of snakes. (HLW)

8427 (UCSD-34P1338X8) GENETIC CONTROL OF ENZYME FORMATION. Mills, S. E. (California Univ., San Diego, La Jolla (USA). Dept. of Biology). [nd]. Contract At(04-3)-34. 7p. Dep. NTIS $4.00.

Studies were conducted on gene-enzyme relationships at the tryptophan synthetase locus in Escherichia coli and other Enterobacteriaceae and on the structure of the anthranilate synthetase-N-anthronilate phosphoribosyl transferase (PRT) complex in these organisms. Other studies were conducted on production of antisera in rabbits, analysis of molecular weights and organization of the enzymes of tryptophan biosynthesis in corn and peas, and purification of anthranilate synthetase in Euglena. (HLW)

Materials

8428 EMISSIONNYE I ADSORBTSIONNYE SVOISTVA VESHCHESTV I MATERIALOV. Spravochnik. (Emission and Adsorption Properties of Substances and Materials. Handbook). Fomenko, V. S.; Podchernyaeva, I. A. Moscow; Atomizdat (1975). 320p.

A presentation is given of electron emission parameters (ionization potential and Richardson constant) for chemical elements, their compounds and films on various backings. For the first time, information is systemized on the adsorption properties of the systems of backing-film and of backing-adsorbed atom, in which both chemical elements and also various compounds participate as adsorbent and as adsorbate. The handbook generalizes a large amount of experimental and theoretical material. The literature source is indicated for each parameter. (1369 references) (tr-SJR)

Physics and Engineering

8429 (ITF-74-147P) EFFECTIVE INTERACTIONS IN GROUPS OF NEUTRAL IDENTICAL ATOMS CONTAINING EXCITED ONES. Yukhnovskii, I. R.; Kadobyanskii, R. N. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1974. 32p. (In Russian). Dep. NTIS (US Sales Only) $4.75.

Some symmetrical configurations of three and four neutral identical atoms are investigated. It is supposed that the atoms are largely separated, the exchange effects are negligible, and these one or two atoms are excited to the energy level with a parity different from that of the ground state. Then the specific resonance interactions between the particles appear. To investigate this interaction the adiabatic and dipole-dipole approximations are used. The energy terms of the groups as functions dependent on the angle which is a parameter of the configurations, are calculated. Some general properties of solutions of the equation determining the terms of the groups of N atoms with N_1 excited ones are given. (auth)

8430 (ITF-75-18P) APPLICATION OF THE COLLECTIVE VARIABLE METHOD TO THE ISING MODEL. II. Investigation of the Behavior of the Pair Correlation Function in the Vicinity of the Phase Transition Point. Yukhnovskii, I. R.; Rudavskii, Yu. K. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1975. 20p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The behavior of the pair correlation function of the Ising ferromagnet, obtained by the collective variable method in the vicinity of the phase transition point, is investigated. It is shown that the most divergent diagrams are formed by the operators D_3, D_4, in the function of the transition to the collective variables. The diagrams with the field vertices, from which more than six lines g(r) come, converge if $T \to T_0$, $H = 0$. (auth)

8431 (JINR-E4-8448) DIAGRAM ANALYSIS OF THE STATIC AND THE SINGLE-SITE APPROXIMATIONS FOR THE HUBBARD MODEL. Weller, W. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 14p. Dep. NTIS (US Sales Only) $4.00.

The static and the single-site approximations applied to the Hubbard model in recent papers are presented in diagrammatical form. The violation of the Luttinger theorem as a consequence of the static approximation is discussed. (auth)

8432 (JINR-P4-8466) MAGNETIC (SPIN) AND MAGNETOELECTRIC POINT GROUPS OF P SYMMETRY. Koptsik, V. A.; Kotsev, I. N. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 22p. (In Russian). Dep. NTIS (US Sales Only) $4.25.

There were 2804 color symmetry groups $G^{(c)}_{ME}$ of magnetoelectric structures and 598 groups $G^{(p)}_{S}$ of magnetic (spin) structures which are isomorphic to the 32 crystallographic point groups G are derived. These groups are subgroups of the direct product of $\bar{P}$ and G groups, where $\bar{P} = \infty\infty\bar{1}1' = R(3) \times 1'$ is the group of all proper and improper rotations and time inversion. The total list of 598 spin groups $G^{(p)}_{S}$ is given. (auth)

8433 (LA-5909-MS) MAGNIFICATION RATIOS FOR EXPLOSIVE-DRIVEN SHOCKS. Fickett, W.; Mader, C. L. (Los Alamos Scientific Lab., N. Mex. (USA)). Apr 1975. Contract W-7405-ENG-36. 4p. Dep. NTIS $4.00.

Measurement of the particle-velocity history at an explosive-driven shock in an inert material is often used to qualitatively infer the velocity profile in the explosive existing at the time the shock enters the inert. A forward-facing characteristic joins each point of the explosive profile to a point on the shock path, cutting off related segments of the profile and path. The magnification ratio at a given shock position is defined as the distance of shock travel into the inert divided by the length of the corresponding explosive profile segment. The magnification ratio vs distance of shock travel, an almost linear function was calculated for several systems. Over the range 0 to 2 times the length of the He it increases from (about) 5 to 10 for PBX9404/aluminum and from 2 to 6 for Comp. B/Plexiglas. (auth)

8434 (TID-26771). ELECTROLUMINESCENCE IN Al–Al_2O_3–Au DIODES. Pong, W.; Inouye, C.; Matsunaga, F.; Moriwaki, M. (Hawaii Univ., Honolulu (USA). Dept. of Physics and Astronomy). 1972. 10p. Dep. NTIS $4.00.

Thin-film diodes composed of Al–Al_2O_3–Au films can be made to emit light under applied voltages. The spectral intensity of the electroluminescence was measured in the wavelength range 2000–6000 A for different diode voltages. In this spectral range, the intensity was found to decrease nearly exponentially with increasing photon energy for a given voltage. The results also indicate that as the intensity of the short-wavelength emission is enhanced with increasing diode voltage above approximately 4 volts, there is a corresponding decrease in intensity in the long-wavelength region. An attempt is made to explain the results in terms of a band model of the oxide. (auth)

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Published March 1975 by the Technical Information Center, Office of Public Affairs, U. S. Energy Research and Development Administration
312 pages, 6 by 9 inches, paper binding
Library of Congress Catalog Card No. 75-600009

Available as CONF-731007
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